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HOTEL AND RESTAURANT MEAT PURVEYORS— IMPROVED METHODS AND FACILITIES FOR CUSTOM SERVICE HOUSES

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HOTEL AND RESTAURANT MEAT PURVEYORS— IMPROVED METHODS AND FACILITIES FOR CUSTOM SERVICE HOUSES

By Clayton F. Brasington, Jr., *industrial engineer,*
Transportation and Facilities Research Division,
Agricultural Research Service, U.S. Department of Agriculture

SUMMARY

The time required as well as the cost involved in performing operations is of particular importance in a custom service house. Such houses prepare (fabricate) ready-to-cook meat cuts for hotels, restaurants, and others on a custom service basis and usually deliver orders the same day they are placed.

This report presents guides for custom service houses, with annual volumes ranging from 1,560,000 to 5,200,000 pounds, for selection of work practices, methods, and equipment that will reduce the cost or time required to perform operations.

The elapsed time, labor requirements, and costs were computed, per 1,000 pounds of product, for alternate methods, practices, or equipment used in receiving and storing meat; fabricating meat; and assembling and loading out customers' orders. These data were then applied to a custom service house with an annual volume of 2,600,000 pounds, handling a selected composition of products. Operators of custom service houses may apply the data in the same manner, using their own volume and composition of products.

Some of the more efficient work practices and methods involved transporting items in larger loads. For example, when the order foreman selected the meat for fabrication in the cooler, he brought four cuts at a time to the fabrication area, assigning work to meat cutters by written work orders. The labor cost for this operation per 1,000 pounds of meat (average for seven types of meat) was $2.22 and the average time required was 0.55 man-hour. Comparable cost for the practice of having each meat cutter select and bring a single cut to the fabrication area was $3.57, and 0.87 man-hour was required.

Use of written work orders, instead of oral orders, helped in saving time and reducing costs in a number of operations. For example, when written orders were used, meat handlers could pick up several fabricated cuts with the identifying orders, transport the cuts in a 4-wheel cart to the weighing area, and weigh, package, and assemble the cuts in the baskets used for customers' orders. The average labor cost for transporting 1,000 pounds of prepared cuts from the fabrication area to the weighing area was $0.55 and the time required was 0.20 man-hour, compared to $1.58 and 0.45 man-hour when meat cutters had received oral orders and hand-carried single cuts. The cost of weighing, packaging, and assembling the fabricated cuts was also reduced because wage rates for meat handlers are lower than those of meat cutters.

Using the least costly methods (described as selected methods in the report) for all operations, the annual labor and equipment cost in the custom service house with an annual volume of 2,600,000 pounds would be $63,000, compared to $75,000 for the next lowest cost methods (described as alternate methods in the report). This is an annual reduction of 16 percent in labor and equipment costs.

The principles of efficient layout for custom service houses are illustrated by a layout for the custom service house with an annual volume of 2,600,000 pounds, designed around the most efficient work methods and practices studied. This layout requires 10,600 square feet. Expansion of the house to handle 4 million pounds annually can be accomplished by a 14-percent increase in the size of the building.

BACKGROUND OF THE STUDY

One of the newer members of the meat industry is the wholesale meat purveyor that provides ready-to-cook meat cuts to hotel dining rooms, restaurants, hospitals, schools, and other establishments that serve meals. Hotel and restaurant meat purveyors have had a spectacular growth within the past several decades, both in number of houses and in volume of meat handled. The number of houses in 1964 was estimated as 1,000, an increase of about 70 percent since World War II. These houses now account for over two-thirds of the total volume of meat and meat products sold to the food service industry.

This report covers hotel and restaurant meat purveyors that prepare roasts, steaks, and other meat cuts, on a custom service basis; such houses deal primarily in fresh meat. They prepare (fabricate) meat ready for cooking according to customer specifications, and deliver orders usually the same day, often within a few hours after the order is placed. It is estimated that approximately two-thirds of the hotel and restaurant meat purveyors operate primarily as custom service houses. Other hotel and restaurant meat purveyors fabricate meat, freeze it, and deliver to customers from inventory; this type of meat purveyor was not included in this study.

Custom service includes the selection of meats of a certain quality, age, and weight, and the cutting, boning, and trimming of the meats in accordance with the customer's specifications. Most custom service houses also handle some items that they do not prepare. These items include packaged frozen meats and provisions such as bacon, hams, sausage, and lunch meat.

Custom service houses vary from those which purchase and prepare few products and sell a few thousand pounds annually to local customers to houses which purchase and prepare a wide variety of products and sell millions of pounds annually to both local and distant customers.

The kinds of customers served by the houses determine to a great extent the type of business of the house. Some houses have as their major accounts expensive restaurants, clubs, and hotel dining rooms, and therefore purchase and prepare top-grade meats and age some cuts. Others cater primarily to drive-in restaurants, hospitals, schools, and other commercial eating places and purchase and prepare meats that are in the middle grades. A number of the larger houses supply all classes of eating places and purchase and prepare both the top and middle grades of meats.

Regardless of the size of the business or the kinds of customers served, most of these houses have to maintain a flexible operation. Very little of the volume handled can be prepared for inventory, and sales are affected by the changing requirements of customers, by the day of the week, by the season, and by the weather. The amount and kind of meat and meat products that will be purchased by customers cannot be accurately predicted, for menus are frequently changed and the houses usually do not know this until the salesman calls for an order. The day of the week has a direct relation to the amount of products sold, since a major portion of the week's volume usually is prepared on the last two or three work days of each week for their customers' needs over the weekend. For the houses near resort areas, the season can affect the volume handled as some houses sell a large portion of their annual volume in several months. Inclement weather usually decreases sales regardless of the day of the week or season, since customers habitually cancel or reduce their normal purchasing pattern during these periods.

The work of the custom service house generally includes the purchasing of meat and meat products and supplies; receiving and storing the purchased items; selling products to customers; selecting, fabricating, and packaging the meat ordered by customers; assembling and loading orders into delivery trucks; delivering orders to customers; and miscellaneous supporting work.

The business hours for these houses are quite long with most houses completely closed for only a few hours during the night.

Many custom service houses use inefficient methods or practices in handling meat through their plants, adding to the time and costs involved in preparing customers' orders. Some houses have higher labor costs than necessary because the work is not properly allocated among skilled and semiskilled workers (meat cutters and meat handlers).

Research was conducted in 10 custom service houses located throughout the country. The weekly volume of these houses ranged from about 30,000 to 100,000 pounds. The objectives of the study were to evaluate in-plant operations and to determine which work methods or practices were the most efficient, and to develop a layout based on the most efficient methods. To obtain the necessary in-

formation, time studies were made of the work methods used in performing operations; flow diagrams were developed to chart the movement of products into, through, and out of the houses; drawings to scale were prepared of the floor plans; work areas, equipment arrangements, storage spaces, and aisles were added to the drawings; and operators and supervisory personnel were interviewed to obtain supplemental data such as product composition, length of storage of products, equipment operating and maintenance costs, and wage rates.

Because of the variation in volume handled by custom service houses, and the wide range in number and type of meat cuts prepared and products handled from day to day, the data collected in this study are presented in two parts. In the first part, the labor requirements and costs are compared for alternate work methods, crew sizes, or types of equipment, per 1,000 pounds of meat and meat products handled. These data are not tied to a particular annual volume or composition of product, nor was an attempt made to cover all possible ways of preparing meats. The second part of the report illustrates how these data may be used to compare work methods and practices in a specific situation. A custom service house of medium size—annual volume, 2,600,000 pounds —and a specific composition of products are used in the illustration. Houses handling this volume generally employed 10 to 15 workers for in-plant operations. Equipment requirements and costs, as well as labor requirements and costs, are computed. A layout is developed based on the most efficient work methods studied. Operators of custom service houses with annual volumes ranging from 1,560,000 to 5,200,000 pounds (employing 7 to 25 in-plant workers) may use these data as guidelines to evaluate work methods in their plants and to determine efficient plant layouts, based on their own annual volume and composition of products.

METHOD OF COMPUTING LABOR AND EQUIPMENT COSTS

Labor costs in this report are based on the productive labor required for the operation and the amount of idle time inherent in the method. Equipment costs are computed on an hourly basis and allocated to separate operations according to hours of use.

These data do not reflect total plant costs, since facility, management, buying, selling, and delivery costs have not been included.

There was a wide variation in wage rates paid to employees in the houses studied. This lack of uniformity was probably due to the scattered location of the selected houses and to the availability of labor in each area. An hourly rate of $3.50 is assumed for meat cutters and order foremen and $2.75 for meat handlers. These rates include the basic hourly wages paid to workers plus fringe benefits such as social security, workmen's compensation, and hospitalization.

Equipment prices were obtained both from the manufacturers and from the suppliers of meat equipment and were based on average f.o.b. factory prices for 1963. Equipment costs are divided into two groups—ownership costs and operating costs (see appendix, table 18). Ownership costs are considered fixed and are computed on an annual basis. These costs are: (1) Depreciation, based on the straightline method and using life expectancy tables from U. S. Treasury Department Internal Revenue Service Publication No. 456 (9-62); (2) interest, based on 6 percent of the average investment over the depreciable life of the equipment; and (3) taxes and insurance, based on a combined figure of 4 percent of the initial investment. Operating costs are based on representative costs in this country and include: Electricity at 2.7 cents per kilowatt hour; water at 0.03 cent per gallon; and maintenance based on estimates made by operators, equipment manufacturing representatives, and the author.

GLOSSARY

Operation. The accomplishment of a sequence of acts or of motions to complete an objective.

Method. The particular manner in which labor and equipment are combined to perform a specific operation.

Time item. An easily timed subdivision (element) of an operation.

Base time. The amount of time required for performing a time item (element) of an operation at a normal pace of a worker skilled in the work.

Fatigue and personal allowances. The time allowed a worker to compensate for weariness resulting from sustained physical effort and the time allowed a worker to cover his personal needs. The fatigue allowance will vary from 5 percent when little physical effort is required, to 25 percent when a great deal is required. The personal allowance is 5 percent. When workers are given rest periods as a part of their normal workday the 5 percent personal allowance should not be included.

Productive time. The time allowed for performing a time item of an operation. It is computed by adding the base time and the fatigue and personal allowances for the time item.

Unproductive time. The idle time which results from an irregular flow of work to individual workers in a crew during the performance of an operation. Also the idle time which occurs when a machine cannot keep the operator busy when it is running at normal capacity.

Elapsed time. The total time, both productive and unproductive, required from the beginning to the end of an operation.

CUSTOM SERVICE HOUSE OPERATIONS—LABOR REQUIREMENTS AND COSTS

The daily work in a custom service house moves at a rapid pace. The order foreman directs the meat cutters and meat handlers in the filling of orders and routes the completed orders for delivery. Roasts, chops, and the like are fabricated to the customer's specifications, ground meat is prepared, patties are made, and other items requested by the customer—frozen meat, provisions, aged meat—are collected from their storage areas. Meat is weighed, wrapped, and labeled, and all the items that make up a customer's order are assembled and placed in delivery baskets. The orders are assembled, by routes, and loaded on delivery trucks. At various times during the week, primal cuts of meat, provisions, and packaged frozen meat are received and stored. Additional work performed, which is not considered part of the daily routine of service to customers, includes the breaking of beef quarters into primal cuts, the preparation of fabricated meat cuts for aging, and such other supporting operations as transporting barrels of fat and bone from work areas.

Facilities used by the custom service houses visited were quite different. Only a few operated in houses designed for their particular needs. The remainder were located in refrigerated warehouses, converted packer branch houses, or remodeled warehouses originally built for other industries. In these plants, work and storage areas often were too crowded, poorly arranged, or poorly located to permit the use of more efficient work methods and equipment. Aisles frequently were both too narrow and too few to minimize handling of individual items, manual transport between work areas, and congestion.

Regardless of the facility used, all houses had the following components: (1) A dock, doorway, or sidewalk space where meat and meat products and supplies were unloaded from trucks for movement to storage; (2) refrigerated rooms, or areas, where fresh meats, meats being aged, provisions, and frozen meats were stored; (3) refrigerated rooms where workers fabricated meat and meat products; (4) rooms or areas where wrapping and packaging supplies and miscellaneous items were stored; (5) rooms where equipment was washed and refrigeration and other machinery was located; (6) a dock, doorway, or sidewalk space (sometimes shared with unloading) where orders were loaded onto trucks for delivery; and (7) office space.

Labor requirements and costs are discussed under four headings: Receiving and storing; selecting, fabricating, and packaging; assembling orders and loading out; and miscellaneous supporting operations. The data presented are based on average labor requirements observed and should be used only as guidelines in evaluating individual facilities, labor requirements, and work methods. No time is shown for workers idle due to lack of a job assignment or, in most cases, for workers to walk from one operation in the house to the area where they will participate in another operation.

In the fabricating operation, labor requirements are based on 1,000 pounds of the product at the beginning of the operation (the in-weight); the yield (out-weight) is usually different from the in-weight because of the separating, trimming, and boning which takes place in converting a piece of meat into a customer cut. A thousand pounds is used instead

of a hundredweight because the larger unit permits more meaningful data on requirements and costs. Although some shrinkage occurs in meat during storage and preparation, it is not allowed for in the data presented herein. The yield assumed for the various cuts of meat during their preparation into customer cuts is based upon the author's evaluation of published data and estimates made by operators of hotel supply houses and workers connected with the meat industry.

The identification of the various meat cuts both before and after they are prepared for customers is based on names listed for the various cuts in "Meat Buyer's Guide to Standardized Meat Cuts" and on names which were in use in most of the houses visited.[1]

Receiving and Storing

Products usually were delivered to the plant in trucks and were unloaded either at a sidewalk or dock beside the building or through a doorway in the building. At houses with receiving docks or doorway floors at or near truckbed level, the truckdriver normally moved the items from inside the truck and placed them on the house transport equipment. At houses where the sidewalk was the receiving area, the truckdriver moved the items to the tailgate of the truck, and the house worker hand-carried individual items to the transport equipment.

Meats received as individual pieces usually were weighed in groups of the same kind, grade, and weight range on either a track or platform scale. A few houses weighed primal cuts such as beef ribs and loins individually on a portable scale as they were unloaded to determine if each one was within the weight range purchased. These cuts were then reweighed in like groups on either a track or platform scale. Beef quarters, hog carcasses, and veal and lamb hindsaddles and foresaddles were unloaded and hung on trolley hooks on overhead rails for transport to the track scale and to storage. Most primal cuts of beef were unloaded onto trolley trees or hooks on overhead rails; however, in some houses that specialized in beef primal cuts such as loins and ribs, these cuts were placed on loin trucks for transport to the platform scale and to storage (fig. 1). In all houses, trimmed primal cuts, as well as smaller cuts of beef, veal, lamb, and pork, often were received in boxes and barrels which were unloaded onto wheeled equipment for transport to the platform scale and to storage. The transport equipment for boxed meats usually was a semilive skid and for barrels, a 2-wheel barrel truck. All boxes of provisions, frozen meats, and supplies usually were unloaded onto semilive skids and transported directly to storage. A few plants weigh frozen meat and provision items that are subject to shrink.

When products reached their respective storage areas, cuts of beef, veal, lamb, and pork hung on trolleys were either left on this equipment or were removed and hung on stationary hooks or placed on shelves. Products on loin trucks and semilive skids were left on the equipment or stacked on shelves. Barrels of meat usually were placed on racks.

One to four house workers were assigned to receiving and storing, depending upon the volume of products received, the number of truck unloading spaces available, the distance products had to be transported to storage, or the desire to get the job done as quickly as possible. Generally it was found that receiving and storing medium to large truckloads required one more worker to complete the job in about the same time when unloading was done at sidewalk level instead of truckbed level.

Since most of the houses studied generally assigned either one or two meat handlers to this work, the data presented are an evaluation of receiving and storing using these two crew sizes when the house layout was similar to the diagram shown in figure 2. At most of these houses, the floor at the receiving area was at or near truckbed level.

All fresh meat cuts on the rail, in boxes, or in barrels were weighed on a combination track and platform scale usually in the same size groups that were transported to storage. Frozen meat and provisions usually were not weighed.

Table 1 shows the labor requirements and costs per 1,000 pounds for one worker and two workers to receive and store products. For each type of meat cut shown, labor requirements and costs are less and the elapsed time is greater when one worker is used under the conditions studied. The labor required per 1,000 pounds, as an average for the 10 types of meat cuts shown in the table, would be 0.20 man-hour for one worker, at a cost of $0.55, and 0.24 man-hour for two workers, at a cost of $0.66. It should be noted, however, that if the average round trip distance were increased by about 30 feet, or the average weight transported were reduced by about 25 percent, a two-worker crew probably would have a lower labor requirement and cost per 1,000 pounds for all items.

[1] National Association of Hotel and Restaurant Meat Purveyors. meat buyer's guide to standardized meat cuts. Rev. ed. 84 pp., illus. Chicago. 1961.

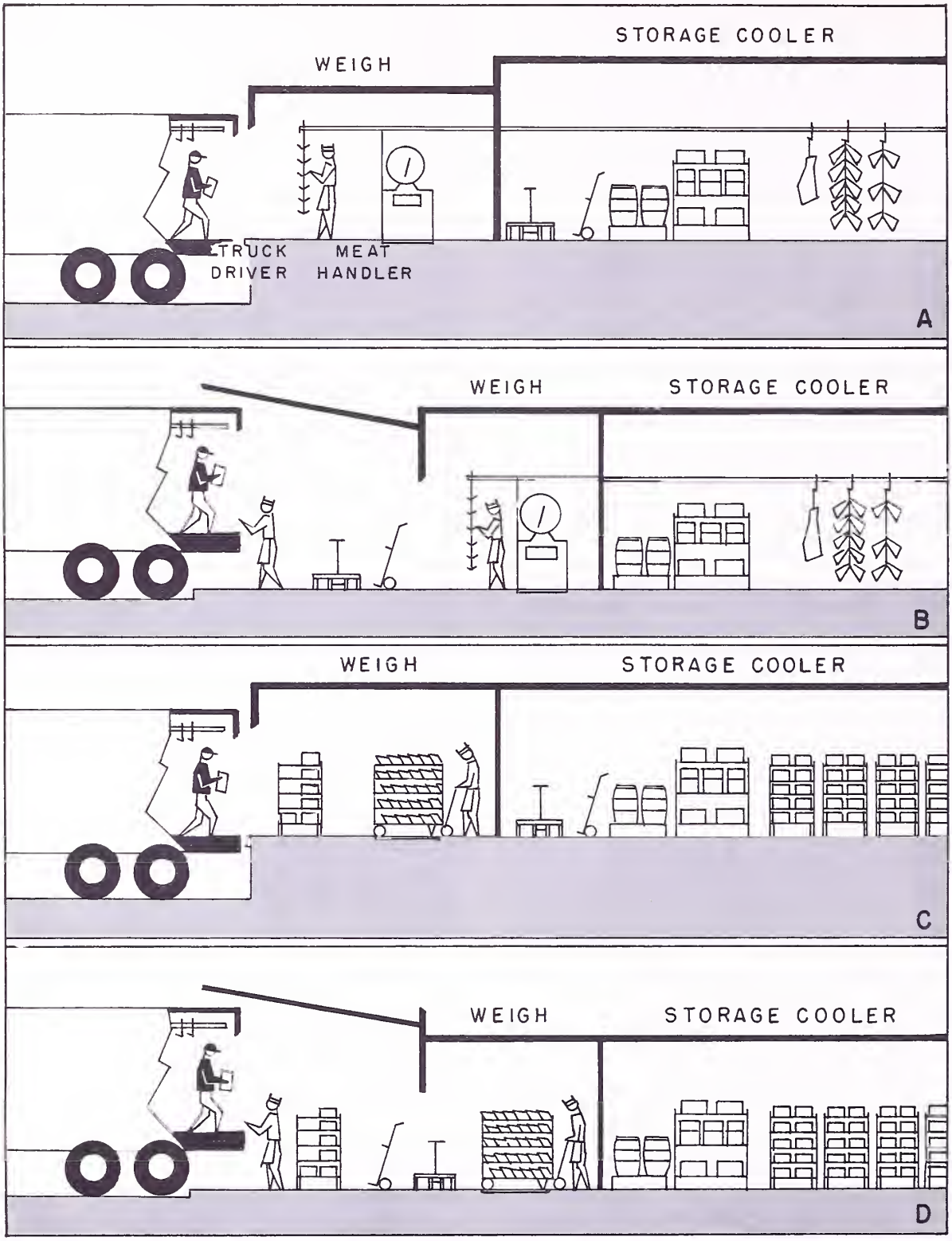

FIGURE 1.—Receiving and storing: On the overhead rail at a dock at truckbed level (A), and at sidewalk level (B), and on loin trucks at a dock at truckbed level (C), and at sidewalk level (D).

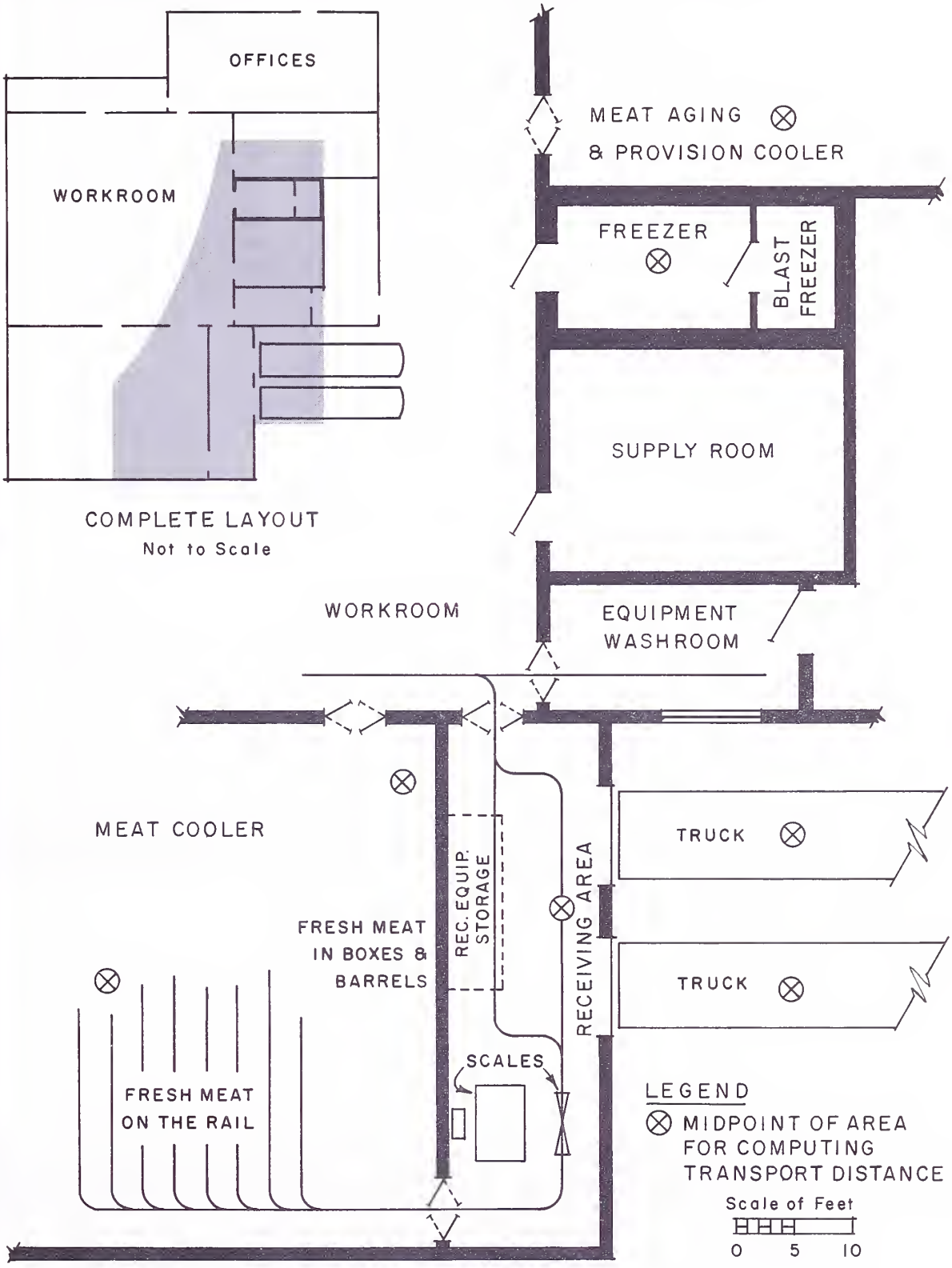

FIGURE 2.—General layout of receiving and storage areas in a custom service house.

TABLE 1.—*Receiving and storing meat, by means of transporting, cut of meat or container, and number of workers*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Means of transporting to storage, and meat cut or container	Average per trip		Per 1,000 pounds									
			1 worker					2 workers				
	Weight transported	Distance (round-trip)	Elapsed time	Labor requirements			Labor costs	Elapsed time	Labor requirements			Labor costs
				Productive	Unproductive [1]	Total			Productive	Unproductive [2]	Total	
	Pounds	*Feet*	*Hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Dollars*	*Hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Dollars*
On the rail:												
Beef quarters	600	140	0.11	0.09	0.02	0.11	0.31	0.07	0.09	0.04	0.13	0.36
Beef rounds or chucks	300	140	.17	.16	.01	.17	.47	.10	.17	.04	.21	.58
Beef loins	720	140	.14	.07	.07	.14	.38	.11	.08	.14	.22	.61
Beef ribs	720	140	.17	.08	.09	.17	.47	.13	.09	.18	.27	.75
Veal foresaddles and hindsaddles	220	140	.23	.21	.02	.23	.64	.14	.22	.05	.27	.75
Lamb foresaddles and hindsaddles	80	140	.59	.59	0	.59	1.62	.32	.59	.04	.63	1.73
Semilive skid:												
Beef, veal, lamb, or pork in boxes	750	128	.13	.08	.05	.13	.36	.08	.09	.06	.15	.42
Frozen packaged meat in boxes	500	136	.21	.12	.09	.21	.58	.11	.12	.10	.22	.61
Provisions in boxes	500	156	.19	.10	.09	.19	.53	.10	.10	.10	.20	.56
2-wheel barrel truck:												
Beef, veal, lamb, or pork in barrels	350	128	.09	.09	0	.09	.25	.06	.10	.02	.12	.34

[1] Waiting for truckdriver to unload.
[2] Waiting for truckdrvier to unload and for receiving worker to complete his job.

Selecting, Fabricating, and Packaging

The selection and fabrication of meat to customers' specifications, the preparation of ground meat and patties, and the weighing and packaging of items for customers are performed in a continuous cycle throughout the day, in which nearly all the plant workers are engaged at the same time. An order foreman usually directs the work. In some houses, the meat cutters select and transport from the meat cooler to their worktables the primal cuts from which the customer cuts are prepared, fabricate the cuts requested, and weigh, wrap, and label them. In other houses, meat cutters devote all their time to fabricating cuts; an order foreman selects and transports the primal cuts to the meat cutters' worktables, and meat handlers weigh and package the fabricated cuts. In all houses, meat handlers usually prepare ground meat in bulk and in patties, collect provisions and aged meats from the coolers as directed by an order foreman, and weigh and package them (fig. 3).

In this report, the continuous cycle of selecting, fabricating, and packaging is broken down into its component parts and the requirements and costs of each part are separately computed.

The operations covered in this section are: Selecting meat and transporting it to the fabricating area; fabricating; preparing ground meat; forming and packaging patties; transporting fabricated cuts, provisions, and aged meats to the weighing area; and weighing, packaging, and labeling.

Selecting Meat for Fabrication and Transporting It to the Work Area

Selecting meat for preparation of customers' orders is an important part of custom service, for the choice made often determines how closely the fabricated cut conforms to customer specifications. In some houses, each meat cutter selected and transported to his worktable the cut he needed to fill an order, and in other houses, an order foreman selected a number of cuts for several orders at one time and trans-

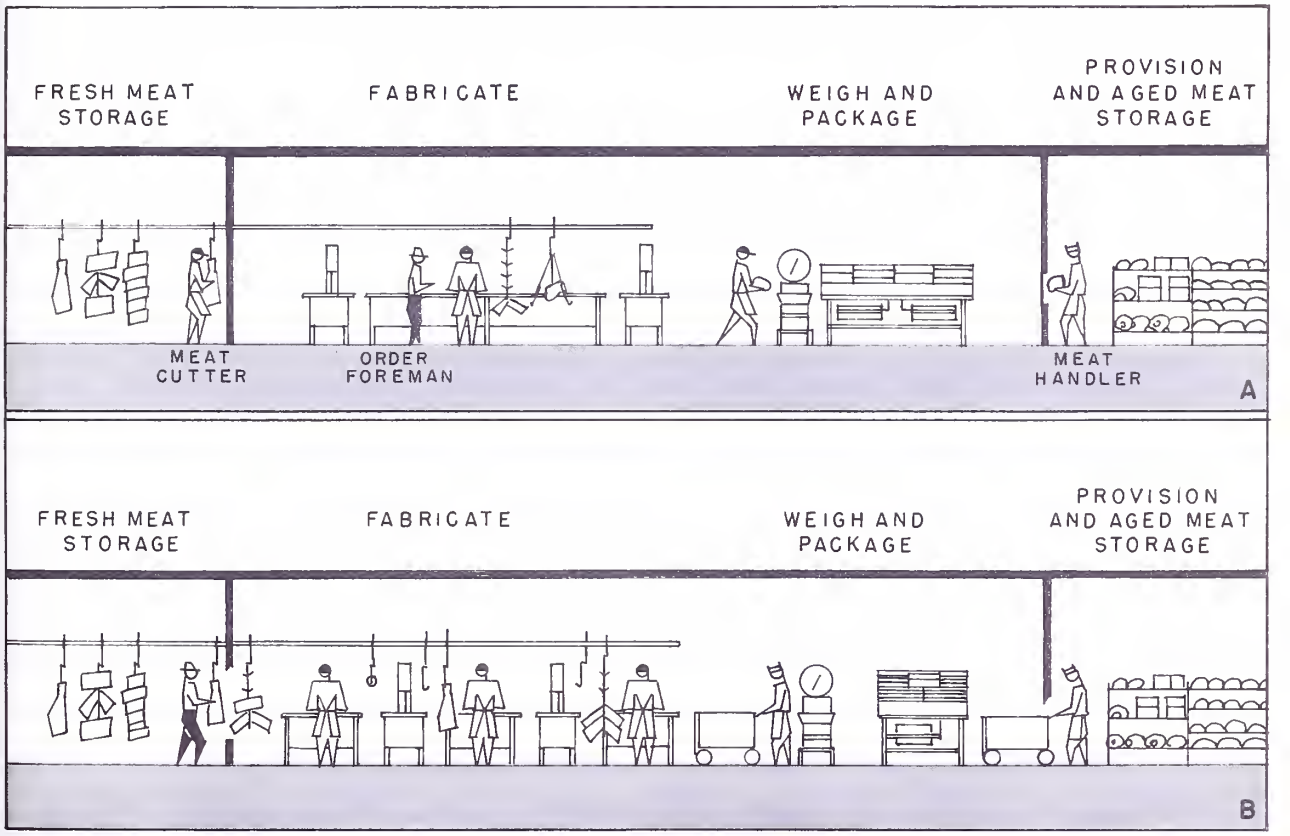

FIGURE 3.—Selecting, fabricating and packaging: (A) Meat cutters select primal cuts in the cooler, fabricate customer cuts, and weigh and package them; meat handlers collect provisions and aged meats from storage and weigh and package these items; (B) an order foreman selects primal cuts; meat cutters fabricate customer cuts; meat handlers weigh and package customer cuts, and collect provisions and aged meats from storage and weigh and package them.

ported them to the fabricating area. In the first method, an order foreman usually gave the meat cutters their fabrication assignments orally, and each meat cutter brought one cut of meat at a time from the meat cooler. All the meat cutters therefore spent time traveling back and forth between the fabricating area and meat cooler. In the second method, the order foreman brought the meat to the fabricating worktables and then gave the meat cutters written work orders.[2] The time of only one man (the order foreman) was spent on trips to the meat cooler and he selected and transported about four cuts at a time.

When meat cutters selected and transported individual cuts of meat to the fabricating area, they usually transported on the rail the beef rounds, chucks, and loins, and the veal foresaddles and hindsaddles; they normally hand-carried beef ribs, lamb foresaddles and hindsaddles, and pork hams and loins. When an order foreman selected and transported four cuts of meat at a time, he used the overhead rail for all the cuts except pork hams and loins, which were transported by 4-wheel cart.

Table 2 shows the productive labor requirements and costs per 1,000 pounds, by cut of meat, for two methods of selecting and transporting. Labor requirements for both methods include the time of an order foreman and meat cutter during the exchange of oral or written work orders. Labor costs range from $1.89 to $6.23 per 1,000 pounds when an order foreman gives meat cutters oral work orders and the meat cutters transport one cut per trip. The average cost per 1,000 pounds (all types of meat shown in the table) would be $3.57, and the elapsed time would be 0.87 hour. When an order foreman transports four cuts per trip and gives the meat cutters written work orders, the range is $1.05 to $3.75 per 1,000 pounds; the average for all types of meat shown in the table would be $2.22, and the elapsed time would be 0.55 hour.

In addition to the savings in time and labor, which are due primarily to a reduction in the number of trips made between the fabrication area and the meat cooler, two other factors of almost equal importance should be considered when evaluating the two methods: When the

[2] See sections Transporting Fabricated Cuts, Provisions, and Aged Meat to the Weighing Area (p.15) and Assembling and Loading Out Orders (p. 17) for discussion of how using written work orders increases efficiency in these operations.

TABLE 2.—*Selecting and transporting meat from the cooler to the fabrication area, by cut of meat, means of transport, and by worker*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Means of transporting and cut of meat	Average transport distance	Average weight of individual cut	Per 1,000 pounds when—					
			Single cut per trip is carried by meat cutters (oral work order) [1]			Four cuts per trip are carried by order foreman (written work order) [1]		
			Elapsed time	Labor required	Labor cost	Elapsed time	Labor required	Labor cost
	Feet	*Pounds*	*Hours*	*Man-hours*	*Dollars*	*Hours*	*Man-hours*	*Dollars*
On the rail:								
Beef rounds or chucks	60	75	0.49	0.54	1.89	0.27	0.30	1.05
Beef loins	60	60	.61	.67	2.35	.30	.34	1.19
Veal foresaddles or hindsaddles	60	55	.66	.73	2.56	.35	.39	1.37
Beef ribs	60	30				.59	.66	2.31
Lamb foresaddles or hindsaddles	60	20				.96	1.07	3.75
Manually:								
Beef ribs	60	30	.67	.79	2.77			
Lamb foresaddles or hindsaddles	60	20	1.00	1.19	4.17			
Pork loins	45	12	1.48	1.78	6.23			
Pork hams	45	.15	1.18	1.43	5.01			
4-wheel cart:								
Pork loins	45	12				.75	.93	3.26
Pork hams	45	15				.60	.75	2.63

[1] Includes time of order foreman and meat cutter during exchange of oral or written work orders.

order foreman selects and transports the primal cuts, responsibility for selecting meat cuts for customers' orders is assigned to one worker, and meat cutters can devote more of their time to fabricating meats.

Fabricating Meat

An almost endless list of products can be fabricated from fresh meats. These products, which may or may not have a particular name, can differ from others of the same kind, quality, and type by one or more of the following factors: weight, length, width, amount of fat, trim, amount of bone, and the way they are cut or tied. In the houses studied, names of similar cuts of meat differed to some extent, and there were also variations in the time required to prepare many cuts. The meat cutters and some of the operators were questioned when time requirements or procedures varied, and the answer usually was that this is the way we do it here. One example of this was the time required for removing a full beef tenderloin from a loin. In some houses the tenderloin was removed with long smooth knife cuts to separate it from the loin, and in other houses as much meat as possible was left on the tenderloin by making many short cuts between the bones on the loin. The time requirements for removing the tenderloin usually averaged less than 1 minute for the first procedure and over 2½ minutes for the second. It was also noted that tenderloins removed by the second procedure required more trimming and therefore more time to smooth the ragged edges along the bone side. Because of the different procedures and time requirements encountered, time study data had to be averaged somewhere between the two extremes and, as a result, the data shown should be used only as guidelines in evaluating the time required to fabricate cuts.

Many other factors were not evaluated that affect the time required to fabricate meats, as they were considered beyond the scope of this study. Some of the more important ones are: The temperature of the meat, the amount of final trimming required by each customer, the quality of the animal before slaughter, and how clean bones should be before they are discarded.

The houses visited had from 4 to 20 meat cutters devoting varying portions of their time to fabricating meat. In some of the smaller and a few of the larger houses, meat cutters devoted about 50 percent of their time to fabricating meat and 50 percent to selecting cuts in the meat cooler and transporting them to the fabricating area and to weighing and packaging finished items. In a number of houses meat cutters fabricated only; other workers supplied them with meat and weighed and packaged finished items.

The equipment used in fabricating meat includes worktables, bandsaws and handsaws, portion scales, steak machines, membrane removers, meat tying machines, scribing saws, and miscellaneous other equipment. The arrangement of this equipment in the houses studied usually depended upon the space available.

Generally three arrangements were found. The first one, which was the most common, was usually found where workrooms were small. A long row of butcher tables was placed against a wall, and a meat cutter had about 4 or 5 feet of a table as a work area. This arrangement is referred to as the multiple worktable method. To either side of the meat cutter were other workers and barrels for bone and fat, and a truckway and overhead rail were located behind him. The rail was about 7 feet from and usually parallel to the row of tables. Meat brought from the cooler was stored on trolleys on the rail until it was needed to prepare customer orders. Bandsaws for sawing steaks, chops, and other cuts were usually located about 6 feet from the work areas of the meat cutters that used them. Even though each meat cutter had 4 or 5 feet of butcher table space, he usually shared either side of the space with his neighbor as a holding area for handsaws, extra pieces of meat, portion scales, etc. As a result, the meat cutter's productivity frequently was impaired because he couldn't place pieces of meat at the best working position in the space available. Moreover, he had to use the back of the table, which was outside normal reach, to place various items of meat or equipment. In this arrangement, meat cutters usually tied cuts of meat by hand (fig. 4).

The second arrangement was observed in a few houses. These houses had individual or single butcher tables 6 to 8 feet long and barrels for bones and fat for each meat cutter. The overhead storage rail for meat was about 4½ feet from and parallel to the tables. The productivity of meat cutters at these tables was usually not affected by other workers since they had ample work areas as well as room on either side of their tables to place items. Bandsaws and meat tying machines (fig. 5) usually were located between the worktables and about 4 feet from the workers that normally used them.

The third arrangement, in which a conveyorized worktable was used, was observed in several larger houses. The conveyorized worktables were about 6 feet wide and from 20 to 30 feet long. Along the middle of the table a

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FIGURE 4.—Tying a cut of meat by hand.

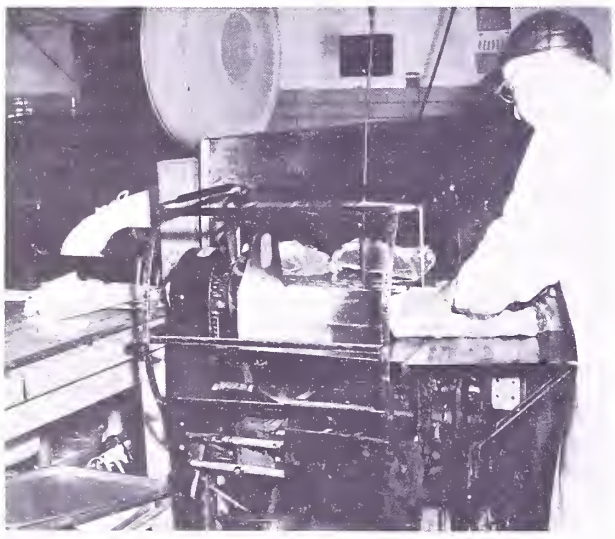

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FIGURE 5.—Tying a cut by machine.

30-inch-wide belt conveyor moved at a speed of about 30 feet a minute. On either side of the belt, meat cutting boards about 18 inches deep ran the length of the table. Meat cutters worked on both sides of the table with about 5 to 6 feet of space allotted to each one. In some houses one or more bandsaws and meat tying machines had been placed along the sides of the table by removing the cutting boards for the space required by the machines. Usually a bandsaw was also located at the "on" end of the conveyorized table and a 6-foot-diameter rotating lazy susan at the "off" end. Overhead rails which held trolleys of meat were about 4½ feet from the "on" end of the conveyor. One of the meat cutters at the "on" end of the conveyor, in addition to his regular work of fabricating meats, was normally given the written work orders for the meats that had been selected in the cooler and transported to the area adjacent to his work place. He would remove pieces to be prepared from the transport equipment and place them and the appropriate work orders on the belt for transport to the other meat cutters as needed. If a bone-in cut such as a rib was to be prepared, this worker frequently would use the bandsaw at the "on" end of the conveyor to remove the excess bone as required by the work order and then place the piece and work order on the belt for transport to the meat cutter.

When a meat cutter completed work on a cut, he placed it on the belt for transport to the lazy susan. Several workers could work together on various steps in separating and preparing some cuts without having to carry them between work areas. Bones, fat, and trimmings were either placed in barrels beside the workers or on the belt and later removed from the lazy susan and placed in the proper receptacles by workers handling the finished products at the lazy susan. Productivity at this table usually was very good as both the work space and holding area provided was generally adequate for each meat cutter.

Data presented here are limited to what is believed to be those items which make up over 90 percent of the cuts fabricated for customers.[3]

Table 3 shows the productive labor requirements and costs per 1,000 pounds, by original cut and work performed on it, for the three equipment arrangements. When the equipment arrangements are evaluated on the basis of average requirements and costs per 1,000 pounds, without any regard for the volume of each cut that might be fabricated, the single worktable arrangement requires 4.14 man-

[3] More detailed data on labor requirements for the cuts listed in table 3 and data on fabrication of other customer cuts may be obtained by writing to the Transportation and Facilities Research Division, Agricultural Research Service, Federal Center Building, Hyattsville, Md. 20782.

hours, at a cost of $14.49; the multiple worktable requires 4.52 man-hours, at a cost of $15.81; and the conveyorized worktable, 4.15 man-hours at a cost of $14.52.

The labor savings for both the single worktable and the conveyorized worktable are due primarily to: (1) Worker productivity not hindered by crowded work areas; (2) a reduction in the distance products are transported between the worktables and the overhead storage rail and the bandsaws; and (3) the use of a meat tying machine to reduce the time required to tie roasts.

TABLE 3.—*Fabricating specified meat cuts from 1,000 pounds of original cut, by kind of worktable arrangement*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Original cut and work performed on it	Estimated yield from 1,000 pounds of original cut	Multiple worktable		Single worktable		Conveyorized worktable	
		Labor required	Labor cost	Labor required	Labor cost	Labor required	Labor cost
	Pounds	*Man-hours*	*Dollars*	*Man-hours*	*Dollars*	*Man-hours*	*Dollars*
Beef rounds (average weight, 75 lb.):							
Cut, partially bone, and trim into rump and shank-off rounds	667	0.47	1.65	0.44	1.54	0.45	1.58
Bone and trim	800	1.25	4.38	1.19	4.17	1.20	4.20
Cut, bone, and trim into knuckles, top rounds, and bottom rounds	666	1.10	3.85	1.04	3.64	1.05	3.68
Beef chucks, square cut (average weight, 75 lb.):							
Cut, bone, and trim into boneless chucks and shoulder clods	827	2.06	7.21	1.94	6.79	1.94	6.79
Boneless chucks, clod out (average weight, 45 lb.):							
Cut into strips for grinding	1,000	1.01	3.54	.96	3.36	.96	3.36
Cut into stew, weigh, and package	667	11.09	38.82	10.57	37.00	10.57	37.00
Shoulder clods (average weight, 17 lb.):							
Trim, cut, and weigh into 4-ounce steaks, cube and package	784	20.29	71.02	19.86	69.51	19.79	69.27
Beef loins, full trimmed (average weight, 60 lb.):							
Cut and saw into short loins and loin ends	1,000	.40	1.40	.35	1.23	.33	1.16
Cut and saw into bone-in strips, full tenderloins, and sirloin butts	1,000	.72	2.52	.65	2.28	.63	2.21
Bone-in strips (average weight, 26 lb.):							
Trim, saw, and weigh into 14-ounce steaks	707	2.78	9.73	2.73	9.56	2.77	9.70
Bone and trim to boneless strips	577	2.52	8.82	2.40	8.40	2.40	8.40
Bone, trim, cut, and weigh into 16-ounce steaks	462	4.13	14.46	4.02	14.07	4.05	14.18
Full tenderloins (average weight, 9 lb.):							
Trim to regular tenderloins	778	2.10	7.35	1.96	6.86	1.82	6.37
Trim, cut, and weigh into 12-ounce steaks	500	4.42	15.47	4.28	14.98	4.23	14.81
Sirloin butts (average weight, 25 lb.): Bone and cut into bottom and top butts	880	1.12	3.92	1.04	3.64	1.08	3.78
Bottom butts (average weight, 8 lb.): Trim	750	3.29	11.52	3.16	11.06	3.16	11.06
Top butts (average weight, 14 lb.):							
Trim	857	.74	2.59	.71	2.49	.71	2.49
Trim, cut, and weigh into 8-ounce steaks	536	4.42	15.47	4.40	15.40	4.46	15.61
Beef ribs (average weight, 30 lb.):							
Bone and trim into rib eye rolls	267	1.36	4.76	1.38	4.83	1.41	4.94
Saw, partially bone, and trim into regular oven-prepared ribs	800	.99	3.47	1.00	3.50	1.03	3.61
Saw, partially bone, and trim into roast-ready ribs	600	2.65	9.31	1.96	6.86	1.99	6.97
Veal hindsaddles (average weight, 55 lb.): Cut and saw into double loins and double legs	1,000	.29	1.02	.26	.91	.24	.84
Veal loins, double (average weight, 10 lb.): Trim, saw, and weigh into 6-ounce chops	675	6.86	24.01	6.72	23.52	6.80	23.80
Veal legs, double (average weight, 45 lb.): Saw, bone, trim, and tie as oven-prepared legs	756	4.73	16.56	3.02	10.57	2.98	10.43
Lamb hindsaddles (average weight, 20 lb.): Cut and saw into double loins and double legs	1,000	.61	2.14	.62	2.17	.60	2.10
Lamb loins, double (average weight, 6 lb.): Trim, saw, and weigh into 4-ounce chops	583	9.58	33.53	9.37	32.80	9.50	33.25

TABLE 3.— *Fabricating specified meat cuts from 1,000 pounds of original cut, by kind of worktable arrangement*—Continued

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Original cut and work performed on it	Estimated yield from 1,000 pounds of original cut	Multiple worktable		Single worktable		Conveyorized worktable	
		Labor required	Labor cost	Labor required	Labor cost	Labor required	Labor cost
	Pounds	*Man-hours*	*Dollars*	*Man-hours*	*Dollars*	*Man-hours*	*Dollars*
Lamb legs, double (average weight, 14 lb.): Saw, bone, trim, and tie as oven-prepared legs	714	12.80	44.80	10.02	35.07	9.94	34.79
Lamb foresaddles (average weight, 20 lb.): Cut and saw into double bracelets and double chucks	1,000	.73	2.56	.76	2.66	.74	2.59
Lamb bracelets, double (average weight, 6 lb.): Trim, saw, and weigh into 4-ounce chops	583	8.80	30.80	8.65	30.28	8.78	30.73
Lamb chucks, double (average weight, 14 lb.): Saw, bone, trim, roll, and tie as shoulders	571	16.62	58.17	14.03	49.11	13.94	48.79
Pork loins, regular (average weight, 12 lb.): Trim, saw, and weigh into 4-ounce chops	917	7.30	25.55	7.29	25.52	7.44	26.04
Pork hams, regular (average weight, 15 lb.): Skin, bone, trim, roll and tie	667	7.29	25.52	5.69	19.92	5.75	20.13

Preparing Ground Meat

Ground meat may be prepared from beef, veal, lamb, or pork. In most houses studied, ground beef of one or two blends of fat and meat made up over 95 percent of the volume prepared each day. Usually the bulk of the meat came from boned chucks, with the remainder from trimmings from bones and prepared cuts. Some houses that sold a large volume of ground meat in proportion to their regular cuts purchased fresh boned beef in boxes and barrels with the fat percentage similar to that needed for ground meat. A number of houses purchased frozen or fresh boned meats with a low fat percentage and during slack periods prepared flanks, briskets, and navels with a high fat percentage to add to this lean meat.

Ground meat was sold in bulk or as patties of various shapes and weight. Ground meat was prepared in some houses as the orders were received and in others it was prepared in advance in anticipation of customer requirements. Since fresh ground meat has a very short shelf life, some bulk packages and patties were prepared and then frozen several days in advance for delivery on days of peak volume in a few houses when their customers would accept them in this state.

There was little variation in the way ground meat was prepared, except in the operating capacity or number of machines used. In most houses the lean and fat meat was blended manually and ground through a coarse plate and then through a fine plate on the grinding machine; or a silent cutter was used for coarse chopping and mechanical blending, and a grinder with a fine plate was used for the final run. In some houses a meat mixer was used between the first grinding or chopping and the final grinding to eliminate manual blending and to obtain a more uniform dispersal of fat throughout the product.

The actual preparation of ground meat normally requires one worker to operate each machine. The number of workers and grinders used generally depends upon the volume prepared, the time available for grinding meat, and the capacity of the equipment. Meat handlers usually prepared ground meat but when a great variety of products and blends was needed, one or more skilled workers and meat handlers did the work.

During the studies it was found that meat was never ground at the grinder manufacturers' rated capacity for the machine. The two reasons advanced for this were that if meat were forced into the machine, it would overheat and lower the quality of the finished product; and that to obtain a uniform blend of fat and meat, it was necessary to constantly hand blend both the cut-up meat as it was fed into the coarse grinder, and coarse ground meat as it was fed into the fine grinder.

Grinding machines of 5-, 7½-, and 15-hp. capacity were used in the majority of the houses studied. Sometimes two 5-hp. grinders were

used in a "piggyback" arrangement, with one worker putting cut-up meat through a coarse grind on one machine, and another worker putting the coarsely ground meat through a fine grind on the second machine.

The elapsed time, labor required, and costs, per 1,000 pounds of ground meat, for two workers using two 5-hp. grinders, and one worker using one 5-, 7½-, or 15-hp. grinder are shown in table 4. The total labor required per 1,000 pounds is less for two workers and two 5-hp. grinders than for one worker and one 5-hp. grinder, because when two machines are used: (1) The coarse ground meat is deposited onto the feed pan of the fine grinder, and does not have to be manually shoveled back onto the same feed pan; and (2) the plates and knives in the grinders do not have to be changed between the coarse and fine grinding of a batch. Although one worker using a 5-hp. grinder takes over half an hour more time per 1,000 pounds of meat than one worker using a 15-hp. grinder, the initial cost of the 15-hp. grinder is roughly 3 times that of the 5-hp. grinder. This factor should be considered in comparing the two grinders. The labor required to bone and cut up chucks for grinding is shown in table 3.

TABLE 4.—*Grinding 1,000 pounds of cut-up beef (through coarse plate and fine plate), by number of workers and horsepower of grinders used*[1]

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Number of workers, and size of grinder used	Elapsed time	Labor required	Labor costs
	Hours	*Man-hours*	*Dollars*
One worker:			
5-hp. grinder	1.98	1.98	5.44
7½-hp. grinder	1.84	1.84	5.06
15-hp. grinder	1.40	1.40	3.85
Two workers, two 5-hp. grinders (piggyback)	.89	1.77	4.87

[1] Beef trimmings and chucks; prepared in five 200-pound batches.

Forming and Packaging Patties

The patty machine most commonly used is designed to form 2,100 patties per hour of operation.[4] An efficiency of about 97 percent was normally achieved because of the temperature or consistency of the ground meat or because worker neglect in keeping the feed hopper supplied with meat occasionally caused defective patties to be formed. This machine could be set up to form various weights and shapes of patties. It inserted a sheet of paper beneath each patty and stacked the patties. Most houses used one meat handler to operate a machine and package patties. A few houses frequently assigned two meat handlers to a machine to speed up production.

Time studies were made of one- and two-man crews forming patties that weighed 4, 2.67, 2, and 1.6 ounces and packing them 5 pounds to a box. The work involved scooping meat from a tub truck and feeding it into the former head, setting up boxes, inspecting patties and packing the correct number to obtain 5 pounds, taping the box lids and labeling them by patty and box weight, replenishing the patty paper supply as needed, and changing the forming parts of the machine to a different weight or shape of patty (this was done after an average of 75 pounds—15 boxes—in each weight was packed).

In a two-man crew, one man scooped meat from the tub truck to the former head and set up, taped, and labeled the packed boxes; the other did the rest of the work.

Table 5 shows the labor requirements and cost per 1,000 pounds for two crew sizes.

Transporting Fabricated Cuts, Provisions, and Aged Meat to the Weighing Area

In many custom service houses, meat cutters carried each cut they fabricated to the weighing area, weighed and packaged the meat, and placed it in the customer's order basket. This usually occurred in houses where meat cutters were given their work orders orally. In houses where meat cutters were given written work orders, meat handlers picked up fabricated cuts, with the identifying work orders, and took care of the weighing and packaging.

Provisions and aged meat that had to be weighed were transported from storage areas to the weighing area by meat handlers. (It is assumed that meat cuts were aged in plastic bags and did not require additional fabrication by the meat cutters.) The order foreman either told the meat handler to pick up one or two items or gave him a list of seven or eight items to pick up. The meat handler carried the items manually when he received oral orders for one or two items and used a 4-wheel cart to transport items when he had written orders for seven or eight items. There was no rule in any of the houses studied as to the number of items selected each trip by either method.

[4] Other types of patty-forming machines with greater production rates were observed in a few houses that made long runs of patties of the same weight and shape; however, these machines were not used in most houses studied.

TABLE 5.—*Forming 1,000 pounds of ground meat into patties and packing in 5-pound boxes, by patty weight and number of workers*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Weight of patty	1 worker					2 workers				
	Elapsed time	Labor requirements			Labor costs	Elapsed time	Labor requirements			Labor costs
		Productive	Unproductive [1]	Total			Productive	Unproductive [2]	Total	
	Hours	*Man-hours*	*Man-hours*	*Man-hours*	*Dollars*	*Hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Dollars*
4 ounces	4.28	4.14	0.14	4.28	11.78	2.83	4.14	1.53	5.67	15.60
2.67 ounces	4.62	4.60	.02	4.62	12.71	3.87	4.60	3.14	7.74	21.29
2 ounces	5.66	5.08	.58	5.66	15.57	4.91	5.08	4.74	9.82	27.01
1.6 ounces	6.70	5.58	1.12	6.70	18.43	5.95	5.58	6.32	11.90	32.74
Average	5.32	4.85	.47	5.32	14.62	4.39	4.85	3.93	8.78	24.15

[1] Waiting for machine to form patties.
[2] Waiting for machine to form patties and for worker to replenish patty paper.

The transporting of fabricated cuts, provisions, and aged meat to the weighing and packaging area was measured separately from weighing and packaging. Table 6 shows the labor requirements and costs per 1,000 pounds for transporting these items manually and by 4-wheel cart, for selected transport distances and weights of the items. The savings in time and labor for the 4-wheel-cart method are directly attributable to the reduction of the number of times the operation is performed per 1,000 pounds. There is also a saving of $0.75 per hour when meat handlers transport the fabricated cuts, as the meat handler's hourly wage rate is less than the meat cutter's.

In houses that used conveyorized worktables, and lazy susans to accumulate fabricated cuts, the cuts were carried to the weighing area by a meat handler. He picked up the cuts, with identifying work orders, and carried them individually. Based on transporting cuts averaging 20 pounds a distance of 7 feet, the labor required for 1,000 pounds of meat was 0.23 man-hour, at a cost of $0.63.

TABLE 6.—*Transporting fabricated cuts, provisions, and aged meat to the weighing and packaging area, by method*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Product, average weight per item, and area transported from	Average transport distance	Manual transport (oral work order)					4-wheel cart transport (written work order)				
		Worker	Items per trip	Per 1,000 pounds			Worker	Items per trip	Per 1,000 pounds		
				Elapsed time	Labor req.	Labor cost			Elapsed time	Labor req.	Labor cost
	Feet		*Number*	*Hours*	*Man-hours*	*Dollars*		*Number*	*Hours*	*Man-hours*	*Dollars*
Fabricated cuts, 20 lb., from fabrication area.	38	Meat cutter.	1	0.45	0.45	1.58	Meat handler.	6	0.20	0.20	0.55
Provisions and aged meat, 10 lb., from cooler.	70	Meat handler.	2	1.05	[1] 1.51	4.50	Meat handler.	8	.62	[1] .99	3.01

[1] Includes time for exchange of oral or written work orders between order foreman and meat handler.

Weighing, Packaging, and Labeling

The two methods normally used to weigh, package, and label customer orders differed only in the type of worker involved and whether packages were tied by hand or by machine.

In some houses where written work orders were used, meat handlers did all the weighing, packaging, and labeling; these houses usually had machines for tying packages. In other houses where work orders were given orally, meat cutters weighed, packaged, and labeled the steaks, chops, and other meat cuts they fabricated. In these houses, meat handlers weighed, packaged, and labeled bulk ground meat, provisions, and aged meat, and all packages were generally tied by hand.

From observations made during the study it was determined that the average package weight for fabricated cuts was 20 pounds, and for bulk ground meat, provisions, aged meat, steaks, and chops, 10 pounds. An average of 20 steaks or chops were packed in each box. The time study data on the two methods were adjusted to these averages.

The meat cutter or meat handler reported the identification and weight of each item to an order foreman, who recorded the weight on the customer's invoice, and told the meat cutter or meat handler the number of the basket[5] assigned for the particular item.

Table 7 shows the elapsed time and labor requirements and costs per 1,000 pounds for both methods, by product grouping. The order foreman's time for recording package weights is the same for each product group for either method. The savings in time and labor for the machine tying method are due entirely to faster tying of packages by machine than by hand. Since the meat handler's hourly wage rate is less than the meat cutter's, there is an additional saving of $0.75 per hour when meat handlers weigh, package, and label steaks, chops, and other fabricated cuts.

[5] The assembling of items in baskets for delivery to customers is described in the next section.

Assembling and Loading Out Orders

Since in most houses, the orders of out-of-town customers were handled on only one or two days in the week and their volume comprised only a small portion of the business, only the assembly and loading out of local orders is discussed.

Assembling orders includes the transporting of items from the packaging tables and the various storage areas to the assembly area and placing them in the numbered baskets assigned to customers' orders. Loading out covers the transporting of the baskets to delivery trucks. The same workers that weigh, package, and label items usually assemble them in the designated containers. Items that do not require weighing and packaging, such as canned hams, bacon, other provisions, and frozen packaged meats, generally were assembled by meat handlers directed by an order foreman. The order assembly area was near the weighing and packaging area in the work room.

TABLE 7.—*Weighing, packaging, and labeling 1,000 pounds of each meat cut or product, by method*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Kind of meat cut or product and average weight per package	Manual tying method (oral work order) [1]				Machine tying method (written work order) [1]			
	Worker	Elapsed time	Labor required	Labor cost	Worker	Elapsed time	Labor required	Labor cost
		Hours	*Man-hours*	*Dollars*		*Hours*	*Man-hours*	*Dollars*
Steaks and chops, 10 lb.	Meat cutter.	4.31	5.22	18.28	Meat handler.	3.77	4.68	13.56
Fabricated cuts, 20 lb.	Meat cutter.	.66	1.12	3.92	Meat handler.	.63	1.09	3.34
Bulk ground meat, 10 lb.	Meat handler.	1.90	2.81	8.42	Meat handler.	1.67	2.58	7.78
Provisions and aged meat, 10 lb.	Meat handler.	1.32	2.04	6.15	Meat handler.	1.26	1.98	5.99
Average	---	2.05	2.80	9.19	---	1.83	2.58	7.67

[1] Includes time of order foreman to record weight of package on customer's invoice; the time is the same for both methods.

The amount of space available for order assembly usually determined which equipment and methods were used both for order assembly and loading out.

In houses with limited space, one or two skids, holding about 10 baskets each, could be used for order assembly. In these houses, work orders were generally given orally, and the order foreman told the workers the basket numbers assigned to customers' orders when the items were packaged or when a worker brought items from storage. All items were hand-carried, both from the weighing and packaging area and from storage. When all the baskets on a skid were filled, they were transported to temporary storage, and after sufficient orders were ready, they were assigned to delivery routes and transported to the delivery truck.

In houses with ample space, 6 to 10 semilive skids with racks (fig. 6) that held about 20 baskets each, could be used in the assembly area. When this equipment was used, the order foreman assigned skids to regular delivery routes, and customers' orders were assigned to baskets and routes before they were assembled. Written work orders were used in these houses, and the order foreman noted the basket number assigned to the customer on the written orders. Items were hand-carried from the weighing and packaging area, but 4-wheel carts were used to transport items from storage. The preassembly routing of customers' orders simplified loading out, because the skids could be taken directly to the delivery truck when the baskets were filled.

Figure 7 shows the procedures involved in the two methods of assembling and loading out orders.

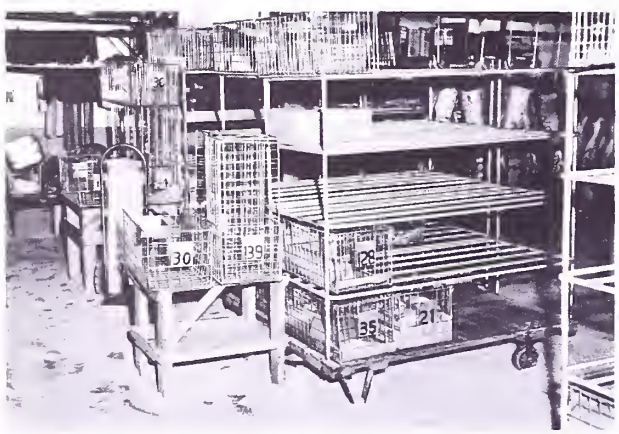

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FIGURE 6.—A semilive skid with racks for holding the numbered order baskets.

Assembling Customer Orders

Fabricated meat, aged meat, bulk ground meat, and provisions that were weighed were hand-carried to the assigned baskets immediately after they were weighed and packaged, by the meat cutter or meat handler who did the packaging. Items such as frozen packaged meat and provisions, which did not have to be weighed, were hand-carried or transported by 4-wheel cart from the freezer or coolers, and ground meat patties, from the patty forming area, by a meat handler, as directed by the order foreman. Meat handlers usually hand-carried 4 packages of patties at a time or 2 packages of provisions or frozen meats in houses where they were given oral orders. Meat handlers transported about 12 boxes of patties or about 8 boxes of provisions or frozen meat in a 4-wheel cart, in houses where they were given written work orders.

The elapsed time and labor requirements and costs per 1,000 pounds to assemble five groups of products in order baskets are shown in table 8. The time of the order foreman is included when he gives the meat handler written or oral instructions. The average transport distance is less for the manual transport method for the five groups of products, as the workers have to walk to only 1 or 2 skids during assembly, whereas with the manual and 4-wheel cart method, usually from 6 to 10 semilive skids with racks are used.

The labor requirements and costs per 1,000 pounds, as an average for all products shown in the table, would be 0.80 man-hour and $2.43 when both meat cutters and meat handlers assemble orders, and 0.78 man-hour and $2.24 when only meat handlers assemble orders.

The elapsed time and labor requirements and costs are greater for the manual and 4-wheel-cart transport method than for the manual method for items transported from the weighing and packaging area (steaks and chops, fabricated meat cuts, and provisions, aged meats, and bulk ground meats) because the workers have to slide the baskets out of the racks before they put in the packages, and they hand-carry the items a greater distance. Using semilive skids with racks, however, increases the overall efficiency of both assembly and loadout.

Loading Out Orders

The two methods of loading out are described here as the preassembly and the postassembly routing methods. The truckdriver's labor is not included in either method as he was not considered a house worker. We used 40 baskets weighing a total of 1,400 pounds as the average load for one delivery truck.

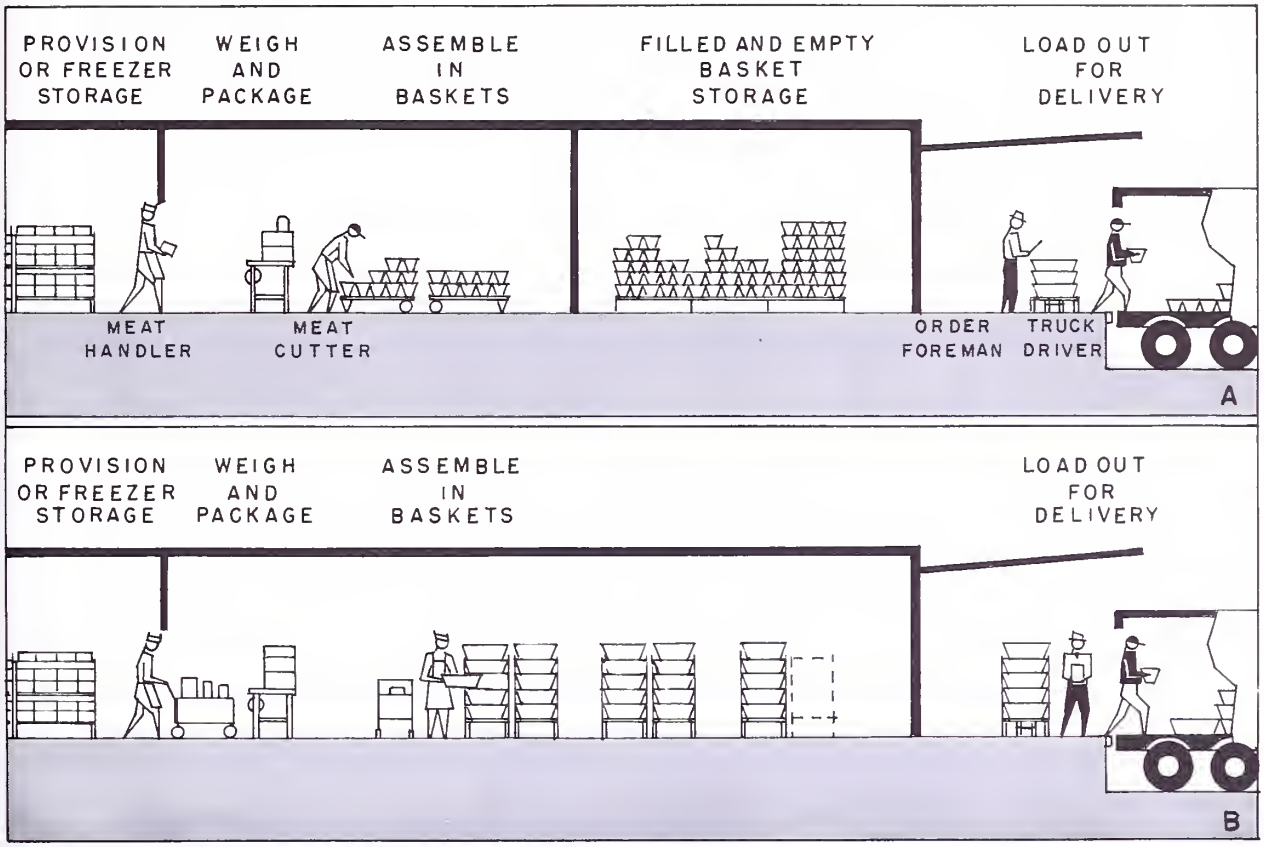

FIGURE 7.—Assembling and loading out orders: (A) Hand-carrying items from storage, assembling items in baskets on semilive skids, storing filled orders (orders are assigned to delivery routes here), and loading baskets from skids on delivery truck; (B) transporting items from storage by 4-wheel cart, assembling items in baskets on skids with racks (orders are routed before assembly because racks are assigned to delivery routes), and loading baskets from skids with racks on delivery truck.

To load one truck, using the preassembly routing method, the order foreman transported two semilive skids with racks, each holding 20 baskets, to the loading dock. He transported one skid at a time. At the loading dock, he called off basket numbers to the truckdriver, in the order in which the baskets were to be loaded on the truck, and checked the items in each basket against the customer's invoice. The truckdriver placed the baskets in the truck, but his time is not included in the labor requirements and costs for the custom service houses. After the truck was loaded the order foreman placed 20 empty baskets on each of the two skids and transported the skids one at a time back to the order assembly area.

Two workers were required when the postassembly routing method was used, and loading out was performed in two steps. First, a meat handler transported skids holding 10 filled baskets each, one skid at a time, from the order assembly area to the temporary holding area. We used 350 pounds (10 filled baskets) as the average load per skid. He unloaded the baskets from the skid and reloaded the skid with 10 empty baskets for the return trip to the order assembly area. Second, when sufficient orders were ready for one or more truckloads, the order foreman made up delivery routes. In the holding area, he called off basket numbers to a meat handler, who located the baskets and loaded them onto skids, 20 to a skid. The order foreman then transported the skids, one at a time, to the loading dock, and called off basket numbers and checked items in the same way as the previous method. After a truck was loaded, he placed 20 empty baskets on each skid and transported them back to the holding area.

The elapsed time and labor requirements and costs per 1,000 pounds are shown for the two methods of loading out in table 9. The savings in labor and costs for the preassembly routing method can be directly attributed to the elimination of the time required in the postassembly method for placing baskets in temporary storage and assembling baskets for routes in this temporary storage area.

TABLE 8.—*Assembling and placing packages in customer baskets, by meat or meat product and method*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Meat product, average weight per package and area transported from	Manual transport (oral work order and postassembly routing [1])						Manual and 4-wheel cart transport (written work order and preassembly routing [2])					
	Average transport distance	Worker	Items per trip	Per 1,000 pounds			Average transport distance	Worker	Items per trip	Per 1,000 pounds		
				Elapsed time	Labor required	Labor cost				Elapsed time	Labor required	Labor cost
	Feet		*Number*	*Hours*	*Man-hours*	*Dollars*	*Feet*		*Number*	*Hours*	*Man-hours*	*Dollars*
Steaks and chops, 10 lb., weighing and packaging area.	8	Meat cutter.	1	0.43	0.43	1.51	15	Meat handler.	1	0.66	0.66	1.82
Fabricated meat cuts, 20 lb., weighing and packaging area.	8	Meat cutter.	1	.22	.22	.77	15	Meat handler.	1	.33	.33	.91
Provisions, aged meats, bulk ground meats, 10 lb., weighing and packaging area.	8	Meat handler.	1	.43	.43	1.18	15	Meat handler.	1	.66	.66	1.82
Provisions and frozen packaged meats, 10 lb., cooler and freezer.	75	Meat handler.	2	1.34	[3] 1.80	5.30	80	Meat handler.	8	.89	[3] 1.26	3.75
Ground meat patties, 5 lb., patty-forming area.	30	Meat handler.	4	.64	[3] 1.10	3.37	45	Meat handler.	12	.74	[3] .98	2.88

[1] Items are placed in baskets on semilive skids; see table 9 for postassembly routing method.
[2] Items are placed in baskets on semilive skids with racks; see table 9 for preassembly routing method.
[3] Includes time of order foreman and meat handler during exchange of oral or written work orders.

TABLE 9.—*Loading customer order baskets of meat on delivery truck, by method* [1]

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Method, equipment, and worker	Average transport distance	Average weight transported per trip	Per 1,000 pounds		
			Elapsed time	Labor required	Labor costs
	Feet	*Pounds*	*Hours*	*Man-hours*	*Dollars*
Postassembly routing, semilive skid:					
Meat handler transports skid loads of 10 baskets each to temporary holding area and unloads baskets	20	350	0.09	0.09	0.25
Order foreman routes orders in temporary holding area, meat handler locates order baskets and assembles 20 per skid, and order foreman transports to loading dock:					
Order foreman	22	700	.38	.38	1.33
Meat handler			.18	.18	.50
Totals	42		.47	.65	2.08
Preassembly routing, semilive skid with racks:					
Order foreman transports skid loads of 20 baskets each to loading dock	35	700	.20	.20	.70

[1] Basket averages 35 pounds; truck delivery load averages 40 baskets or 1,400 pounds. Time of truckdriver is not included.

Miscellaneous Supporting Operations

A number of operations that were performed daily, several times a week, or monthly were not considered a part of the normal daily routine of service to customers. Included in these miscellaneous supporting operations were: (1) Breaking beef quarters into primal cuts; (2) preparing fabricated meat cuts for aging; (3) transporting barrels of bone and fat between work areas and the loading dock; (4) receiving and storing packaging supplies; (5) transporting packaging supplies to the work areas; (6) cleaning equipment and facilities; (7) arranging products in storage rooms; and (8) maintaining facilities and equipment. Data on labor requirements were obtained for breaking beef quarters and preparing meat for aging. These data and a discussion of the other supporting operations are given in the appendix.

Discussion of Work Practices and Methods

Work practices and methods that permit meat cutters to spend more time fabricating meat, assign semiskilled workers to jobs that do not require special knowledge or training, and allow the transport of larger loads between work areas can save time and reduce labor costs in custom service houses.

The use of written work orders, rather than oral orders, is a practice that permits more efficient utilization of the time of both meat cutters and meat handlers. It can affect most of the daily operations carried out in the house. This practice permits the transport of products in larger loads than when work orders are given orally and also allows meat handlers to transport, weigh, package, and assemble fabricated cuts—work which is done by meat cutters in many custom service houses.

When written work orders are used, an order foreman (or a meat cutter assigned to this task) can make the selection of meat for fabrication and transport several cuts at a time from the cooler to the fabrication area instead of having each meat cutter make trips to the cooler and transport one cut at a time. For meat hung on the rail, usually no additional equipment would be necessary to transport several cuts at a time. A 4-wheel cart could be used for other cuts, if the volume were sufficient to warrant it.

After a meat cutter fabricates a cut for a customer's order, use of the written order to identify the cut permits a meat handler to pick up the order, and several others at the same time, transport them to the weighing and packaging table and do the weighing and packaging, leaving the meat cutters free to continue fabrication work.

With the identifying written order, the meat handler can follow through with the assembling of fabricated cuts in order baskets for customers. If the house has sufficient space to assemble the orders by routes, additional time

can be saved in loading out by placing the route number, as well as the order basket number, on the written work order when it is made out.

Meat handlers can also transport larger loads of frozen meat, provisions, and aged meat to the assembly area when they are given written rather than oral orders. A 4-wheel cart can be used to transport a number of items from either the fabrication area or storage areas.

Lack of space may limit use of transport equipment in some custom service houses, but the use of written work orders should still permit meat handlers, instead of the more highly paid meat cutters, to transport, weigh, package, and assemble fabricated cuts.

Arranging work areas so that each worker has adequate space, with a minimum of interference from other workers, also has an effect on efficiency. This effect cannot be measured as readily as the effect of transporting products in larger loads; however, time studies of fabrication at single and multiple worktables do show an average time of 4.14 man-hours per 1,000 pounds of meat (32 specified types of cuts) for a worker at a single worktable and 4.52 man-hours for a worker at a multiple worktable. The time requirements for a single worktable included the use of a machine for tying cuts rather than tying by hand as was the case for the multiple worktable. The conveyorized worktable would be most useful in a house that prepared a sufficient volume of roasts and cuts requiring aging to have at least four meat cutters working full time on this work and on the boning of cuts. The principles of efficient layout are described and an example of an efficient layout for a custom service house is given in the following section of this report.

Several jobs in a custom service house may be readily done by one worker, rather than two, but the time saved by having two workers do the job may be more important to management in certain instances than the cost.

For example, two workers using two 5-hp. grinders piggyback can grind 1,000 pounds of meat in about 55 minutes. The next fastest method studied was one worker using a 15-hp. grinder; the time required was nearly 1½ hours. When one worker used one 5-hp. grinder, the time required was almost 2 hours. The cost of the equipment, the time requirements, and the average daily volume of meat ground must be considered in choosing the method most suitable for a particular house.

The number of workers assigned to receiving and storing depends on how quickly the job must be done, the amount of product received at one time, the amount that can be transported to storage per trip, and the distance from the receiving area to storage areas. The time saved by using two men rather than one, for the distances and amounts transported per trip described in this report, averaged only 5 minutes per 1,000 pounds of meat for 10 types of meat. The labor cost averaged 66 cents per 1,000 pounds for two men, and 55 cents for one man.

Management should carefully examine both labor and equipment requirements, and their costs, to determine which work methods and practices will be most economical and useful for a particular situation.

The next section of this report presents a comparison of labor and equipment costs for the methods described, using a custom service house with an annual volume of 2,600,000 pounds as a basis for the comparison.

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

A custom service house of medium size—annual volume 2,600,000 pounds—was selected to illustrate the comparison of labor and equipment requirements and costs for alternate work methods and practices. A layout is also presented for a house of this size, based on the most efficient methods and equipment studied, and principles of efficient layout are discussed.

The assumed composition of products received annually by the house is shown in table 10. The movement of these products through handling and processing operations in the house is illustrated in figure 8.

The labor and equipment requirements were developed and the layout was designed for the volume that would be handled in each operation on a peak-volume day. The volume handled on a peak-volume day is based on a weekly volume of 50,000 pounds of meat and meat products. On the peak-volume day, we assumed that 20 percent of the weekly volume is received, and 25 percent of the weekly volume is handled in all other operations. Receipts should be kept to a minimum on the peak-volume day, because the workers are needed in other operations. We used 20 percent of the weekly volume because this was the average in most of the houses observed. The assumed composition of products, by operations, annually and on the peak-volume day, is shown in table 11. We used the same transport distances, when they appear in operations, as were used in the previous section of the report.

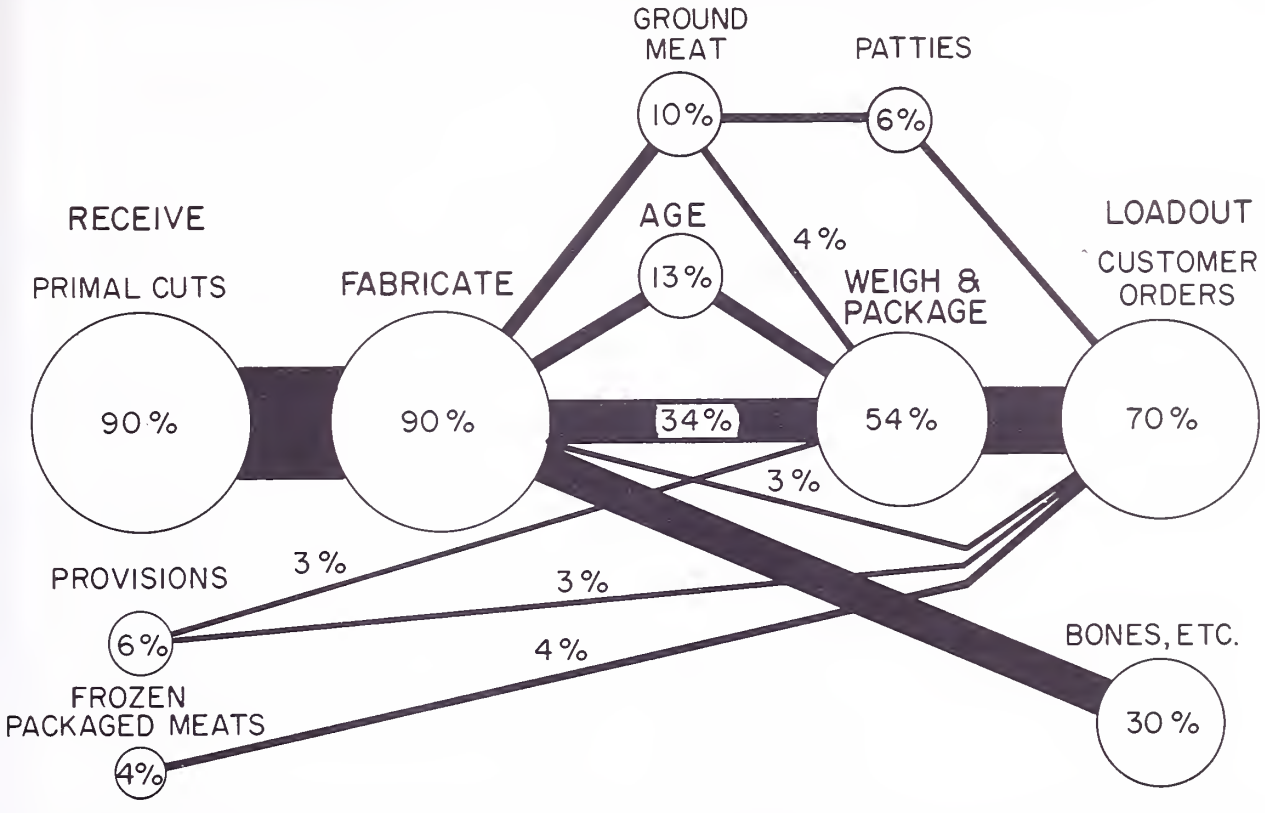

FIGURE 8.—The assumed in-plant distribution of meat and meat products for a custom service hotel supply house handling 2,600,000 pounds annually.

Labor and Equipment Requirements and Costs

Considering both the labor and equipment required to perform operations, the volume of product involved in operations on the peak-volume day, and the annual volume handled, we compared methods for performing all in-plant operations. The methods and equipment found to have the lowest overall costs were designated the selected methods and those with the next lowest overall costs, the alternate methods. These methods and the equipment used in each operation are:

METHODS AND EQUIPMENT

Operation	Selected method	Alternate method
Receiving and storing	One worker Trolley hook and trees, overhead rail, rail switches, track and platform scale, semilive skids, and jacklift.	Two workers. Same equipment as in Selected Method.
Selecting cuts from cooler and transporting to the fabrication area.	Group of cuts transported by order foreman; written work orders. Trolleys and trees, overhead rail, rail switches, 4-wheel cart.	Individual cuts carried by meat cutters; oral work orders. Trolleys and trees, overhead rail, rail switches.
Fabricating	Single worktable; tying cuts by machine. Worktables, bandsaws, over-under scales (20 and 5 lb.),[1] steak machine, tub truck, meat tying machine.	Multiple worktable; tying cuts by hand. Worktables, bandsaws, over-under scales (20 and 5 lb.),[1] steak machine, tub truck.
Preparing ground meat	One worker and 15-hp. grinder Grinder, tub trucks	One worker and 7½-hp. grinder. Grinder, tub trucks.

METHODS AND EQUIPMENT—Continued

Operation	Selected method	Alternate method
Forming and packaging ground meat patties.	One worker and one machine Patty former and stand, packaging table, tub truck.	Two workers and one machine. Same as in Selected Method.
Transporting fabricated cuts, provisions, aged meat to weighing area.	4-wheel cart, written work orders; meat handlers do all transporting. 4-wheel cart	Manual transport, oral work order; meat cutters transport items they prepare, meat handlers do the rest. No equipment.
Weighing, packaging, and labeling	Machine tying, written work orders; meat handlers do all weighing and packaging. Dial bench scale, packaging table, tub truck, package tying machine.	Manual tying, oral work orders; meat cutters weigh and package items they prepare, meat handlers do the rest. Dial bench scale, packaging table, tub truck.
Assembling orders	4-wheel cart and manual transport, written work orders; meat handlers do all assembly, orders are routed before assembly. Semilive skid with racks, order baskets, 4-wheel carts.	Manual transport, oral work orders; meat cutters assemble items they prepare, meat handlers do the rest, orders are routed after assembly. Semilive skids, order baskets.
Loading out	Preassembly routing, order foreman takes baskets on skid with racks directly to loadout. Semilive skids with racks, jacklift, order baskets.	Postassembly routing, meat handler takes filled baskets to temporary storage, assists order foreman in routing orders, order foreman takes baskets on semilive skid to loadout. Semilive skids, jacklift, order baskets.
Preparing cuts for aging	Conveyor hot-water dip; 4-wheel cart transport, written work order, meat handlers transport cuts to preparation area. 4-wheel carts, meat bagging table, meat cut holder, vacuum and clip machine, hot water conveyor tunnel, holder for bone cover material.	Manual hot-water dip; manual transport, oral work orders, meat cutters carry cuts to preparation area. Meat bagging table, vacuum and clip machine, hot-water dip tank, baskets, semilive skid, jacklift.
Transporting bones, fat, and miscellaneous from work areas.	One worker 2-wheel barrel truck	One worker. 2-wheel barrel truck.

[1] The dial shows the amount over or under the desired weight of the product.

A full description of how the operations (through loading out) are performed was given in the first section of the report. The methods of preparing cuts for aging are described in the appendix. Data on labor requirements for transporting by 2-wheel barrel truck are also in the appendix. The number of items of equipment required and the hourly cost for use of the equipment are given in the appendix (table 18).

Table 12 lists the labor and equipment requirements and costs of operations, by method, on the peak-volume day.

For receiving and storing, the requirements and costs are based on a volume of 10,000 pounds of meat and meat products; the various kinds of meat are received in the same percentages as shown in table 10 for the annual volume.

A total of 11,250 pounds of beef, veal, lamb, and pork primal cuts is selected in the cooler and transported to the fabrication area on the peak-volume day. The amounts of the various kinds of meat involved are shown in the appendix in table 19, which gives the composition and volume of products fabricated on the peak-volume day.

The 11,250 pounds of primal cuts selected yield 7,518 pounds of meat plus 3,732 pounds of bones, fat, and miscellaneous products.[6] The meat yield includes 6,268 pounds of fabricated customer cuts, 844 pounds of beef chucks for grinding, and 406 pounds of beef trimmings from the fabricated cuts; the trimmings are

[6] The miscellaneous products are an insignificant part of the volume (about 0.5 percent); they include round rumps, veal flanks, and lamb foreshanks, flanks, and briskets. These products were not prepared into customer cuts during the study of fabrication in the houses visited.

TABLE 10.—*Assumed composition of meat products received annually*

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Type of product	Average unit weight	Total units	Total weight	Percentage of total
	Pounds	*Number*	*Pounds*	*Percent*
Primal cuts:				
Beef rounds	75	4,420	331,500	12.75
Beef chucks (square cuts)	75	4,680	351,000	13.50
Beef loins (full trimmed)	60	19,760	1,185,600	45.60
Beef ribs	30	13,000	390,000	15.00
Veal hindsaddles	55	260	14,300	.55
Lamb hindsaddles	20	520	10,400	.40
Lamb foresaddles	20	520	10,400	.40
Pork loins (regular)	12	2,600	31,200	1.20
Pork hams	15	1,040	15,600	.60
Subtotal		46,800	2,340,000	90.00
Packages:				
Frozen meats	50	2,080	104,000	4.00
Provision items	50	3,120	156,000	6.00
Subtotal		5,200	260,000	10.00
Total		52,000	2,600,000	100.00

used to make ground meat. The labor and equipment requirements and costs for fabricating are based on preparing the 6,268 pounds of fabricated customer cuts and cutting up the 844 pounds of beef chucks for grinding. (See table 11, and table 19 in the appendix, for product composition.)

For this house, the single worktable is the selected method and the multiple worktable, the alternate method. The conveyorized worktable was not included because its high initial cost and operating cost cannot be justified for the volume of fresh meat handled by this house.

A total of 1,250 pounds of ground meat is prepared (844 pounds from cut-up beef chucks and 406 pounds from beef trimmings) on the peak-volume day. In addition to the labor and equipment required to grind the meat, we included requirements to transport the cut-up and ground meat in tub trucks between storage in the cooler and work areas and for the worker to walk between the areas when necessary to obtain tub trucks of meat. We assumed that about 200 pounds of meat was transported on each trip. The amount of meat and distances involved were: 1,250 pounds of cut-up meat was transported 60 feet from the fabrication area to storage in the cooler, and the same amount 50 feet from the cooler to the grinder. After the meat was ground, 750 pounds was transported 35 feet from the grinder to the patty forming area, and 500 pounds, 25 feet from the grinder to the weighing and packaging area.

The labor and equipment cost for one worker and one 15-hp. grinder (the selected method) is $8.17, and for one worker and one 7½-hp. grinder (the alternate method), $8.49. Total costs for the other methods which were observed would be: $8.57 for two workers and two 5-hp. grinders (piggyback) and $8.63 for one worker and one 5-hp. grinder.

On the peak-volume day, 750 pounds of ground meat patties are formed and packaged. We assumed that equal amounts of the four patty weights (4, 2.67, 2, and 1.60 ounces) are formed and packaged, and that all are packed 5 pounds to a box.

A total of 4,643 pounds of fabricated cuts is transported from the fabricating area to the weighing and packaging area when the alternate method is used, and 4,231 pounds when the selected method is used. In the alternate method, 412 pounds of stew meat and cubed steaks is included. Stew meat and cubed steaks are weighed and packaged at the time they are fabricated, but they must be transported to the weighing and packaging area, in the alternate method, so the order foreman can assign the items to the customer order baskets. In the selected method, where written work orders are used and the order basket number is placed on the work order, stew meat and cubed steaks are transported by meat handlers from the fabricating area directly to the order baskets. A total of 2,000 pounds of provisions and aged meat is transported to the weighing and packaging area from the meat aging and provisions cooler, by either method.

Items weighed, packaged, and labeled at the weighing and packaging area on the peak-volume day include 6,731 pounds of steaks, chops, other fabricated cuts, bulk ground meat, provisions, and aged meat (see table 11).

The total volume of products assembled and placed in customer order baskets is 8,768 pounds; the weight of each product grouping handled in this operation is shown in table 11. Stew meat and cubed steaks are brought from the weighing and packaging area in the alternate method and from the fabricating area in the selected method. Other items are assembled as described in the first section of this report.

The volume of products assembled is the volume loaded out.

A total of 1,625 pounds of fabricated beef cuts are prepared for aging on the peak-volume

TABLE 11.—*Assumed composition of meat products by operations, annually and on a peak-volume day*

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Operations and products	Annual weight		Peak-volume day weight [1]	
	Pounds	*Pounds*	*Pounds*	*Pounds*
Receiving and storing:				
Beef, veal, lamb, and pork primal cuts	2,340,000		9,000	
Frozen packaged meats	104,000		400	
Provisions	156,000		600	
Total		2,600,000		10,000
Selecting and transporting primal cuts to fabrication area		2,340,000		11,250
Fabricating:				
Customer cuts for immediate delivery	965,835		4,643	
Customer cuts for aging	338,000		1,625	
Boned beef chucks cut up for grinding	175,500		844	
Beef trimmings for grinding	84,500		406	
Bones, fat, and miscellaneous	776,165		3,732	
Total		2,340,000		11,250
Preparing ground meat		260,000		1,250
Forming and packaging patties		156,000		750
Transporting customer cuts to the weighing area		965,835		4,643
Transporting provisions and aged meats to the weighing area		416,000		2,000
Weighing, packaging, and labeling customer products: [2]				
Steaks and chops	360,035		1,731	
Other fabricated cuts	520,000		2,500	
Bulk ground meat	104,000		500	
Provisions and aged meats	416,000		2,000	
Total		1,400,035		6,731
Assembling packages in assigned customer order baskets:				
Steaks and chops	360,035		1,731	
Stew meat and cubed steaks	85,800		412	
Other fabricated cuts	520,000		2,500	
Bulk ground meat	104,000		500	
Provisions and aged meats (weighed)	416,000		2,000	
Ground meat patties	156,000		750	
Provisions and frozen packaged meats (not weighed)	182,000		875	
Total		1,823,835		8,768
Loading customer order baskets for delivery		1,823,835		8,768
Preparing customer cuts for aging		338,000		1,625
Transporting bones, fat from fabrication area		776,165		3,732

[1] It is assumed that 20 percent of a week's volume would be received, and 25 percent prepared, assembled, and loaded out on a peak-volume day.

[2] Stew meat and cubed steaks are weighed and packaged at the fabrication table, so they are not included in this operation.

day. Table 19 (appendix) shows the assumed composition of products which make up this volume.

On the peak-volume day, 3,732 pounds of bones, fat, and miscellaneous are transported in barrels from the fabrication area to the receiving dock. It is assumed that the average filled barrel contains 207 pounds of bones, fat, or miscellaneous, and 18 round trips, 65 feet each way, are made between the fabrication area and the receiving dock in transporting both empty and filled barrels.

The costs for performing the operations are $303.50 with the selected methods and $360.26 with the alternate methods. This is a difference of $56.76 for a peak-volume day. The peak-volume day involves 25 percent of the weekly volume for all operations except receiving and storing. It was assumed that the volume of products involved in receiving and storing is divided equally among the five operating days each week. On a yearly basis, the reduction in costs with use of the selected methods would amount to $11,902.80, or about 16 percent.

Most of the savings realized are labor costs, as the overall equipment costs for the selected methods are about 32 percent higher. The labor savings are generally due to having the

TABLE 12.—*In-plant labor and equipment requirements and costs of handling meat on a peak-volume day, by operation and method* [1]

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Operation	Selected methods [2]					Alternate methods [2]				
	Requirements		Costs			Requirements		Costs		
	Labor	Equipment	Labor	Equipment	Total	Labor	Equipment	Labor	Equipment	Total
	Man-hours	*Machine-hours*	*Dollars*	*Dollars*	*Dollars*	*Man-hours*	*Machine-hours*	*Dollars*	*Dollars*	*Dollars*
Receiving and storing	1.62	4.76	4.46	2.38	6.84	2.26	3.33	6.22	2.48	8.70
Selecting meat for fabrication and transporting it to the work area	4.51	11.59	15.79	1.55	17.34	7.62	15.36	26.67	1.47	28.14
Fabricating meat	44.11	63.74	154.39	4.96	159.35	46.97	66.48	164.40	4.12	168.52
Preparing ground meat	1.92	5.34	5.28	2.89	8.17	2.48	7.01	6.82	1.67	8.49
Forming and packaging patties	3.99	11.96	10.97	1.98	12.95	6.59	9.88	18.12	1.94	20.06
Transporting fabricated cuts, provisions, and aged meats to the weighing area	2.91	2.17	8.56	.10	8.66	5.11	0	16.33	0	16.33
Weighing, packaging, and labeling	16.08	10.02	47.69	2.15	49.84	17.33	12.22	57.97	.87	58.84
Assembling customer orders	5.73	5.77	16.14	2.98	19.12	4.95	2.82	15.30	1.12	16.42
Loading out orders	1.75	5.27	6.13	2.37	8.50	5.70	12.36	18.18	3.40	21.58
Preparing fabricated meat cuts for aging	2.71	13.66	7.45	4.43	11.88	3.44	11.19	9.84	2.49	12.33
Transporting bones and fat	.29	.29	.80	.05	.85	.29	.29	.80	.05	.85
Totals	85.62	134.57	277.66	25.84	303.50	102.74	140.94	340.65	19.61	360.26

[1] On a peak-volume day, it is assumed that 20 percent of the week's supply of meat and meat products are received and stored and 25 percent of the week's customer orders are filled; see table 11 and text for volume involved in each operation.

[2] Selected methods are the methods found to have the lowest cost and alternate methods are the methods having the next lowest cost (see tables 1-9 and accompanying text for methods for particular operations; also see appendix, tables 15–16).

skilled workers, meat cutters, devote their entire time to fabricating cuts, to using semiskilled workers to transport, weigh, and package customer cuts, and to employing equipment which reduces or eliminates some of the labor requirements in performing various operations.

Table 13 shows the labor requirements and costs by operation and worker (meat cutter, meat handler, order foreman) for the two methods for the peak-volume day. The labor requirements shown are for the productive labor only for the operations described. No time has been included for workers to change jobs or to prepare or clean up work areas.

The labor requirements given here should be of help to operators of custom service houses in determining work schedules and crew sizes for a specific situation. No specific recommendations are made on crew size or how the work should be scheduled because, in a service-type business of this kind, management should provide for as much flexibility as possible, including the judicious use of overtime.

Layout

Five major factors should be considered in planning a layout for a custom service house. These are: (1) Volume of business to be handled, (2) paths of flow for meat and meat products, (3) space requirements, (4) size, type, and number of pieces of equipment required and their arrangement, and (5) future expansion. The volume of business to be handled has a material effect on the size of the building and on the kind and type of equipment needed. Thus at the outset, the anticipated volume should be determined as to the composition of products handled both on an annual basis and

TABLE 13.—*Summary of in-plant labor requirements and costs of handling meat on a peak-volume day, by operation, worker, and method* [1]

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Operation and worker	Selected method		Alternate method	
	Labor requirements	Labor costs [2]	Labor requirements	Labor costs [2]
	Man-hours	*Dollars*	*Man-hours*	*Dollars*
Receiving and storing: Meat handler	1.62	4.46	2.26	6.22
Selecting meat for fabrication and transporting it to the work area:				
Order foreman	3.99	13.97	.82	2.87
Meat cutter	.52	1.82	6.80	23.80
Subtotal	4.51	15.79	7.62	26.67
Fabricating meat: Meat cutter	44.11	154.39	46.97	164.40
Preparing ground meat: Meat handler	1.92	5.28	2.48	6.82
Forming and packaging patties: Meat handler	3.99	10.97	6.59	18.12
Transporting fabricated cuts, provisions, and aged meats to the weighing area:				
Meat handler	2.17	5.97	2.10	5.78
Order foreman	.74	2.59	.92	3.23
Meat cutter	0	0	2.09	7.32
Subtotal	2.91	8.56	5.11	16.33
Weighing, packaging, and labeling:				
Meat handler	11.46	31.52	3.59	9.88
Order foreman	4.62	16.17	4.62	16.17
Meat cutter	0	0	9.12	31.92
Subtotal	16.08	47.69	17.33	57.97
Assembling customer orders:				
Meat handler	5.23	14.39	2.72	7.49
Order foreman	.50	1.75	.75	2.63
Meat cutter	0	0	1.48	5.18
Subtotal	5.73	16.14	4.95	15.30
Loading out orders:				
Meat handler	0	0	2.37	6.52
Order foreman	1.75	6.13	3.33	11.66
Subtotal	1.75	6.13	5.70	18.18
Preparing fabricated meat cuts for aging:				
Meat handler	2.71	7.45	2.94	8.09
Meat cutter	0	0	.50	1.75
Subtotal	2.71	7.45	3.44	9.84
Transporting bones and fat: Meat handler	.29	.80	.29	.80
Total, meat handler	29.39	80.84	25.34	69.72
Total, order foreman	11.60	40.61	10.44	36.56
Total, meat cutter	44.63	156.21	66.96	234.37
Grand total	85.62	277.66	102.74	340.65

[1] Based on composition and volume of products in table 11.

[2] Labor costs for each worker classification were adjusted in some instances to agree with the labor and equipment requirements and costs table.

on a peak-volume day. On the basis of these determinations, the type, size, and number of pieces of equipment and the space requirements for the house can be established.

The paths of the flow for meat and meat products are very important in laying out an efficient house. The flow for various types of meat and meat products and supplies should be short and direct and should be planned to minimize handling, manual transport between work areas, and congestion. This necessitates not only the proper arrangement of plant components, but also the best location of work areas in the various components with adequate traffic aisles to serve them.

Space requirements for all storage areas should be based on the largest anticipated volume to be held at any one time, the length of the storage cycle, and the type of equipment which will be used within these areas. For the assumed house: The meat cooler would have a storage capacity for 30,000 pounds of beef, veal, and lamb on the rail and 750 pounds of pork loins and hams in boxes on shelves; the meat aging and provision cooler would have a storage capacity for a 2-week inventory of aged meat and a 2½-week supply of provisions; the freezer would have storage capacity for a 2-week supply of frozen packaged meats; and the supply room would have a total of 230 square feet of floor space, not including 4-foot-wide aisles, for storing packaging supplies (on shelves), clothing for workers, and miscellaneous items.

The space requirements where operations are performed should be based on the number, type, and size of equipment used at these areas plus the amount of work space needed for workers operating the equipment.

The arrangement of equipment should provide for economy of movement of products and supplies between work stations, efficient performance of operations, and required sanitation practices. The size, type, and number of pieces of equipment required should be determined by an evaluation of the ownership and operating costs, the volume to be handled by the equipment, and the labor requirements and costs to operate it.

The house should be designed so that future expansion will not present a major construction problem. Where expansion is anticipated, removable nonbearing walls should be used. Plans for expansion should provide for the removal of a minimum amount of exterior wall.

Inspection and sanitation authorities have rigid requirements for construction of these houses. Operators planning new houses or the expansion of existing ones should submit their plans to proper authorities for approval before beginning construction.

A layout for a hotel supply house handling 2,600,000 pounds annually is shown in figure 9.

Space requirements in all areas are based on a peak-volume day. The components of the house are: Receiving dock, meat cooler, workroom, loading dock, aging and provision cooler, freezer, supply room, equipment washroom, machinery room, inspector's office, welfare room, and general offices. The house contains 10,587 gross square feet.

Receiving Dock

The receiving dock would be used for receiving meat, meat products, and supplies, and also for receiving empty barrels and loading out filled barrels of bone and fat. The dock is 12 feet deep, 42 feet long, and 50 inches high, or truckbed level. It is enclosed to protect products on the dock from weather, insects, and pilferage. Two 8-foot-wide openings are suggested for unloading trucks. The openings should be equipped with overhead doors. Actually only one opening is needed for receiving, based only on the number of hours the dock is used each week; however, since it is often necessary to receive other products during the time a large truckload is being unloaded, an additional opening is provided.

The dock is located at the rear corner of the house. It is adjacent to the meat cooler and workroom; 5-foot-wide doorways provide access to these rooms. This location provides comparatively short distances of travel for transporting products to storage.

The dock is equipped with overhead rails for transporting primal cuts from trucks to the meat cooler and for transporting empty trolleys from the workroom or equipment washroom to storage on the dock. A combination track and platform scale is located on the dock. The track portion of the scale would be used for weighing primal cuts hung on trolleys and the platform for weighing boxes of meat on semilive skids.

Meat Cooler

The size of the meat cooler should be determined by the volume and composition of products to be stored, the length of the storage period, the space needed between overhead rails to provide adequate air circulation and to prevent meats from being damaged by other pieces while being moved along the rail, the rail length required per trolley load by type of product, the shelf space needed for boxes of meat, the floor space needed for tub trucks and other wheeled trucks to be held overnight, and

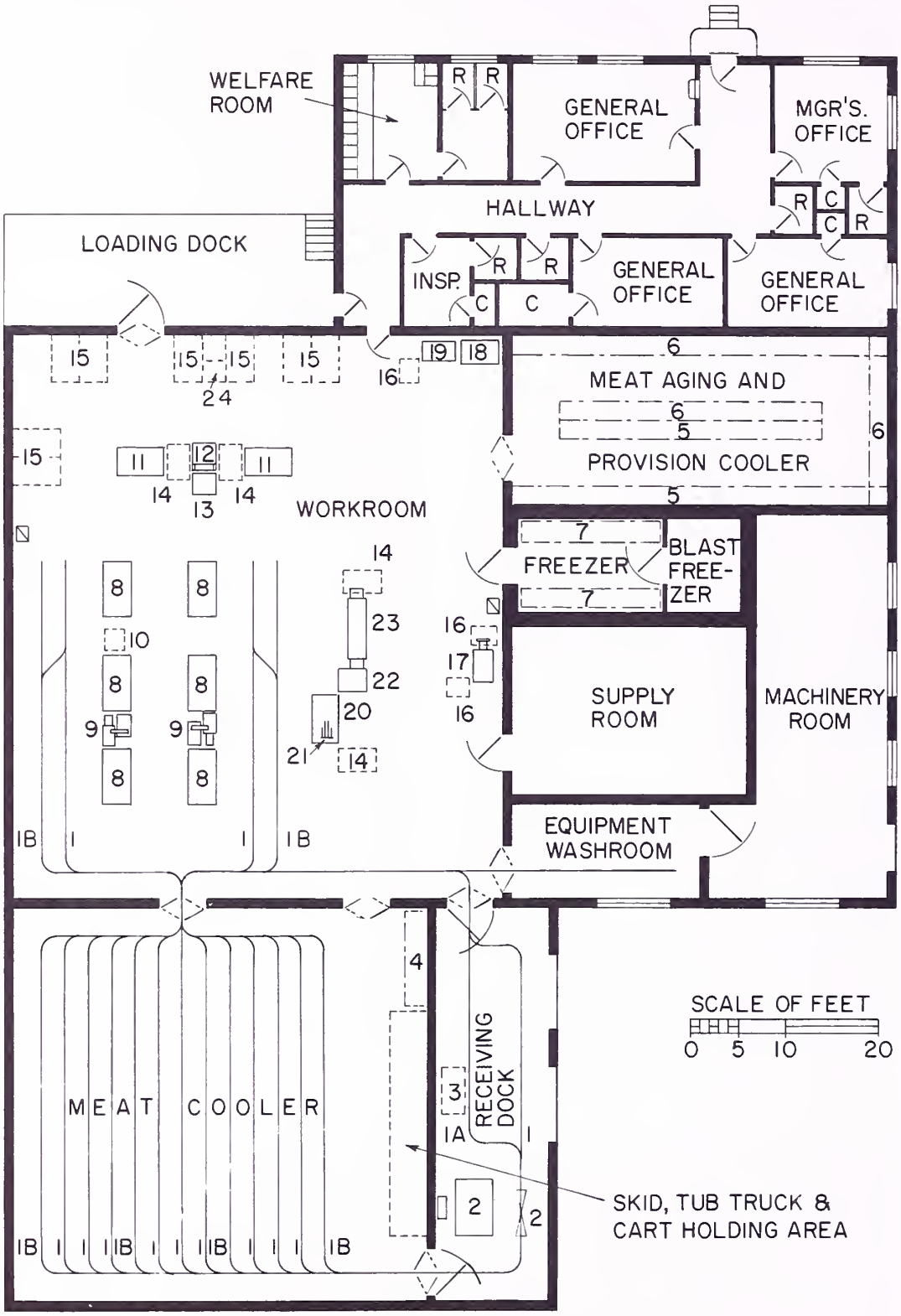

FIGURE 9.—Layout for a custom service hotel supply house handling 2,600,000 pounds of meat and meat products annually.

Legend
1. Overhead transport & storage rail
1A. Overhead trolley storage rail
1B. Overhead work rail
2. Track & platform dial scale
3. Semilive skid storage
4. Pork storage shelves
5. Provisions storage shelves
6. Beef aging storage shelves
7. Frozen products storage shelves
8. Fabrication table
9. Bandsaw
10. Meat tying machine
11. Meat packaging table
12. Dial bench scale
13. Order desk
14. Four-wheel cart
15. Semilive skids with racks
16. Four-wheel tub truck
17. Meat grinder
18. Patty packing table
19. Patty former
20. Meat bagging table
21. Meat cut holder
22. Vacuum and clip machine
23. Hot water conveyor tunnel
24. Package tying machine
R. Restroom
C. Closet
▨ Lavatory

FIGURE 9.—Continued.

the work rails and aisle space needed for moving products in and out of the cooler.

In accordance with recommendations made by operators of houses and studies made of meat cooler capacities in relation to volume handled, the cooler shown on the layout has a rail holding capacity (based in general on the assumed product composition) of 30,000 pounds of beef, veal, and lamb cuts and a shelf capacity of 750 pounds of pork cuts. This capacity allows an operator some flexibility in purchasing products, since he can on occasion pick up additional fresh meat cuts and hold them in the cooler until they are needed without disrupting the normal flow and inventory of the other meat cuts used to fill customer needs.

The number of feet of overhead rail needed to store 30,000 pounds of primal cuts is determined by: (1) The number of primal cuts of each type, (2) the number hung on each trolley, and (3) the length of rail needed for each trolley by type of product. Table 14 shows that 309 feet of overhead storage rail is needed for the 30,000 pounds of primal cuts.

TABLE 14.—*Overhead rail requirements for the meat cooler for storing 30,000 pounds of primal meat cuts*

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Primal cuts	Pieces stored	Pieces hung on each trolley	Rail length required per trolley	Length of storage rail
	Number	*Number*	*Feet*	*Feet*
Beef rounds	58	1	1	58
Beef chucks	61	1	1	61
Beef loins	258	6	3	129
Beef ribs	168	12	3	42
Veal hindsaddles	5	1	1	5
Lamb hindsaddles	7	1	1	7
Lamb foresaddles	7	1	1	7
Total	564			309

The cooler layout shows nine overhead rails 36 feet long for storing the 30,000 pounds of primal cuts. In addition to these rails, work rails are needed for assembling cuts and for moving them in and out of the cooler. Four rails the same length as the storage rails and parallel to them are suggested for this purpose. The 1st, 5th, 9th, and 13th rails are designated as work rails.

The outside rails would be located 3 feet from the cooler walls to prevent the meat from touching the walls during transport. The work and storage rails are spaced 2½ feet apart to provide for adequate air circulation and an easier selection and transport of primal cuts. Houses that hang more than one meat cut on each trolley-tree hook should use a spacing of 3 feet.

The 750 pounds of pork primal cuts in boxes are stored on tiered shelves in the cooler. Three shelves 10 feet long for a total of 30 linear feet should be more than adequate.

The amount of cooler floor space needed for storing tub trucks and other wheeled equipment overnight varies. A space 4 feet by 24 feet is allowed in the layout.

The meat cooler shown on the layout is 44 feet wide and 42 feet deep. It has storage rails for holding 30,000 pounds of primal cuts on trolleys, work rails for transporting cuts into and out of storage, shelves for 750 pounds of primal cuts in boxes, an overnight holding area for wheeled equipment, and a truckway for moving products into and out of the cooler.

It is located adjacent to both the receiving dock and the workroom and has one doorway opening onto the dock and two doorways opening into the workroom. The doorway opening onto the receiving dock is 5 feet wide and is equipped with two double-swing vestibule doors on the cooler side and a refrigerator door on the dock side. The vestibule doors remain closed except when something is actually passing through the doorway, and they permit the outer refrigerator door to remain open during receiving without a great loss of refrigeration.

The two doorways opening into the workroom are 5 feet wide, and each one is equipped with two double-swing vestibule doors to reduce moisture penetration into the meat cooler during the daily cleanup and to better control the temperature and humidity within the cooler.

Workroom

The workroom is used for performing the following operations: (1) Fabricating meat products, (2) preparing ground meat, (3) forming and packaging patties of various weights, (4) preparing meat cuts for aging, (5) transporting customer cuts to the weighing area, (6) transporting ground meat to the weighing area, (7) selecting and transporting provision items and aged meats to the weighing area, (8) weighing, packaging, tying, and labeling customer products, and (9) assembling and placing packages in order baskets assigned to each customer. The workroom is located adjacent to the meat cooler, the receiving dock, the equipment washroom, the supply room, the freezer, the meat aging and provision cooler, and the loading dock. Two lavatories are located in the workroom; these are required to meet inspection requirements.

Fabricating meat products.—The fabrication of beef, veal, lamb, and pork into customer cuts is performed in one part of the workroom adjacent to the meat cooler. Space is provided for six fabrication tables, two bandsaws, a meat tying machine, overhead work and storage rails, bone and fat barrels (not shown on layout; located where needed at the fabrication tables), work areas, and an aisle.

Separate fabrication tables 3 feet wide by 6 feet long are provided for each meat cutter to allow ample work space and temporary storage space to hold meat cuts before or after fabrication. The tables are arranged in two rows separated by an aisle. This provides a compact arrangement and tends to isolate the fabrication area from interruptions by workers performing other operations within the workroom.

Two bandsaws are provided, one in each row of fabricating tables. One saw could handle all the sawing based upon the hours of use; however, two are suggested to reduce delays when more than one saw is needed at the same time, and to reduce the distance between the tables or overhead rails and the bandsaws.

One meat tying machine is suggested, since the machine is mounted on casters and can be easily moved from one location to another in the fabrication area.

Two overhead rails are provided behind each row of fabrication tables. The outer rail for each row would be used to transport primal cuts from the meat cooler to the area where it is to be fabricated. The inner rails would be used to hold a supply of primal cuts behind each fabrication table. A 4-foot distance between the inner rail and the tables is suggested, since only the meat cutters will be using this space.

The two overhead rails behind each row of tables are 2½ feet apart. A single rail connects these rails to the rails in the meat cooler, the equipment washroom, and the receiving dock.

A 6-foot-wide aisle is provided between the two rows of fabricating tables. This aisle would provide access to each table without interference to the meat cutter, and would allow completed cuts to be loaded onto wheeled carts for transport to the next operation.

The arrangement of the fabrication area shown on the layout requires a space 32 feet by 28 feet. It should permit each meat cutter to perform his work with a high degree of efficiency since it provides adequate work space plus holding space on individual tables, a shorter distance between the overhead storage rail and the table or bandsaw, and eliminates interruptions caused by other workers passing through the work space between the tables and the overhead rails.

Preparing ground meat.—In this area a space 7 feet by 15 feet is provided for a 15-hp. meat grinder and two tub trucks. The grinder is placed next to a wall near the meat cooler where most of the meat to be ground will be stored. It is also located adjacent to a main traffic aisle in the workroom so that ground batches of meat in tub trucks can be easily transported to either the patty former or order weighing area.

Forming and packaging patties.—A patty forming machine on a wheeled stand, a table for holding empty boxes and packed boxes of patties, and a tub truck of ground meat is the equipment needed for this operation. The space provided for the equipment and worker is 11 feet by 10 feet and is located on an aisle near the semilive skids which hold customer order baskets in one corner of the room.

Preparing meat cuts for aging.—This operation is located adjacent to the fabrication area and between the meat cooler and the meat aging and provision cooler. It is also adjacent to a main traffic aisle so that meats can be easily moved on wheeled equipment both to and from this area. The following equipment is shown on the layout for preparing meat cuts for aging: A 32- by 60-inch table equip-

ped with a meat cut holder, a holder for bone covering material, and shelves for meat aging bags; a vacuum and clip machine; a hot-water dip conveyor; and two 4-wheel carts for transporting and holding meat cuts before and after they are prepared for aging. This arrangement permits one worker to efficiently perform this operation with a minimum of walking between the different pieces of equipment.

An area 10 by 27 feet is allowed for preparing meat cuts for aging. This space will provide an adequate area for the performance of the operation.

Weighing, packaging, and labeling customer products.—This operation is performed in an area adjacent to the meat fabrication area and next to the area where packages are placed in assigned customer order baskets. Space is provided for two 32- by 60-inch order-packaging tables, a dial scale on a wheeled stand, a 30- by 30-inch order desk, two 30- by 48-inch 4-wheeled order carts, and a package tying machine. There is also sufficient space for a tub truck of ground meat for bulk ground meat orders.

An area 16 by 28 feet is allowed for this operation; it should provide ample work and aisle space for the three workers that normally work in this operation.

Assembling and placing packages in assigned customer order baskets. — Customer orders are assembled and placed in assigned order baskets in an L-shaped area adjacent to a doorway opening onto the loading dock. The space provided for this area, including the aisles between skid racks, is 5 by 48 feet.

Eight semilive skids with racks are suggested for holding baskets for customer orders during order assembly and for transporting them to the loading dock. Each skid is 3 by 5 feet and has four racks (fig. 6). The four racks plus the skid top would provide space for 20 order baskets. Studies made at the houses visited indicated an average customer order requires two baskets, so one skid with racks could hold 10 customer orders. It is assumed that 20 customer orders—two skids with racks and baskets—would make up an average delivery truck route. The eight semilive skids with racks and baskets would provide space for placing packages in 160 order baskets for 80 customer orders, for four delivery routes. The skids are placed on the layout in four groups of two with an aisle betweeen each group for workers placing packages in the customer order baskets.

This arrangement permits customer orders as they are received at the order desk to be assigned to empty baskets on semilive skids designated as to delivery routes.

The workroom shown on the layout is 52 by 60 feet and the space not assigned to various operations is designated as aisles for either wheeled equipment or pedestrian traffic. These aisles are arranged so that they tend to segregate operations, and thereby reduce interruptions and interference by workers engaged in other activities.

The workroom has nine doorways. The doorway opening onto the loading dock and the one onto the receiving dock have two double-swing vestibule doors on the room side and 5-foot-wide refrigerator doors on the outside. The two doorways into the meat cooler, the one into the meat aging and provision cooler, and the one into the equipment washroom are 5 feet wide and have two double-swing vestibule doors. The doorway into the freezer is 4 feet wide and has a freezer door on the workroom side. The supply room has a 4-foot-wide refrigerator-type door on the workroom side, and the doorway into the hallway to the offices has a 2½-foot-wide refrigerator-type door.

Loading Dock

This dock is used for loading customer orders into delivery trucks. It is located adjacent to the order assembly area in the workroom to minimize travel distance in transporting filled customer order baskets from their holding area in the workroom to the delivery trucks.

The loading dock shown on the layout is 12 feet deep by 35 feet long. The height of the dock should be at the delivery truckbed level (about 45 inches). It is suggested that a shed-type roof be placed over the dock, that it slope downward toward the building wall, and overhang the front edge of the dock by about 4 feet. This type of roof should protect both the customer orders and the workers during inclement weather. A 5-foot-wide doorway into the workroom and a 2½-foot-wide doorway into the hallway to the offices is provided. Steps are at one end of the dock.

The 35-foot length of the dock will permit three delivery trucks to be parked in position for loading at one time. The 12-foot depth provides enough space for loaded skids with racks to be positioned at the rear of trucks for loading, working space around the skids, and traffic space along the wall for moving skids into and out of the workroom.

Meat Aging and Provision Cooler

This cooler is used for storing meat for aging and provisions (bacon, frankfurters, luncheon

meats, cured hams, sausages, canned meats, etc.). The size of the cooler should be based on the average dimensions and weight of the packages stored, the number of packages in a stack, the length of the storage period, and the amount of aisle space needed. The cooler, as shown on the layout, is located near the areas where meat is prepared for aging and where aged meats and provisions are assembled for customer orders.

It was assumed earlier in the chapter that meat cuts would be aged an average of 2 weeks. According to the assumed composition of products for the house, 970 packages of aged meats would make up a 2-week supply. It was determined during this study that an average bagged product for aging occupied 0.9 square foot of space, so if aged meats are placed in single layers on the shelves an average of two deep (2-foot-wide shelves), a 2-week supply would take 437 linear feet of shelves. The layout provides meat aging shelves 2 feet wide, 6 shelves high, and 80 feet long for a total of 960 square feet or 480 linear feet of shelves. This allows about 10 percent more linear feet of shelving than is required.

A 2½-week supply of provisions was also assumed. The assumed composition of products for the house would require storage space for 750 packages at 10 pounds each for a total of 7,500 pounds. Since it was assumed that provisions would be received in cases holding an average of 50 pounds, space would be required for 150 cases. It was determined during the study that an average case requires 4 square feet of space. If the cases were stacked 2 high on each shelf (shelf 2 feet deep), 300 square feet of shelves would be needed. The cooler provides provision storage shelves 2 feet deep, 3 shelves high, and 66 feet long, for a total of 396 square feet.

This provides ample space for the house to have a very flexible purchasing policy; it can take advantage of good buys without disturbing normal inventory requirements.

The cooler is 18 feet wide and 40 feet deep. The shelves for aged meats and provisions are along three walls and in the middle of the room, and 5-foot-wide aisles provide easy access to all shelves.

Freezer

The freezer is located adjacent to the meat aging and provision cooler and near the area where customer orders are assembled. Workers, when they are selecting provision items for orders, can often combine the selection of frozen items in the same trip and thereby reduce the number of separate trips needed. Since frozen packaged meats are normally received in large skid loads, the distance to the receiving dock is a relatively minor consideration in its location.

The freezer shown on the layout has one room for holding a 2-week supply of frozen packaged meats on shelves and another room for freezing meats. The frozen packaged meat storage room has storage shelves 2 feet deep, 3 shelves high, and 30 feet long for a total of 180 square feet of space. The 2-week supply of frozen packaged meat weighs 4,000 pounds. It is assumed that each 50-pound case of 10-pound boxes would require 4 square feet. If these cases are stacked 2 high on each shelf (shelf 2 feet deep), it would require 160 square feet of shelving. The extra 20 square feet of shelves provides some flexibility in the storage of products.

The freezer storage room is 10 feet wide and 16 feet deep with a 5-foot aisle between the two rows of shelves. A space of 6 inches is allowed at the rear of each row of shelves and at either end for adequate air circulation. The blast freezer room is 10 feet wide and 8 feet deep and will permit the house to use wheeled equipment to transport products to be frozen into the room. This room could be equipped with shelves and used as a freezer or as additional freezer storage space depending upon the needs at a particular time. The room has a 4-foot-wide door leading into the storage freezer.

Supply Room

The supply room has a door opening into the workroom, since most of the items kept in this room will be used there. The supply room is 18 feet wide by 25 feet deep and contains approximately 230 square feet for storing supplies and a 4-foot-wide U-shaped aisle to provide access to them. A room this size could hold a week's supply of items such as clothing for the workers and a month's supply of wrapping and patty paper, boxes, and meat aging bags. The actual inventory held in the room will depend entirely upon how many different types of paper, boxes, etc., that management requires for packaging customer products. For example, it could be that for some houses handling this volume the room would be too small because many different packaging materials are used and large inventories are purchased. For others, the room would be too large since the houses would use only a few kinds of packaging materials and would purchase most supplies as needed.

Equipment Washroom

The equipment washroom has one 5-foot-wide door opening into the workroom and another 5-foot-wide door opening into the machinery room. It is 10 feet wide and 20 feet deep, and would be used for washing wheeled equipment and trolleys. It would be equipped with a vat for washing the trolleys and hot water connections and hoses for washing the wheeled equipment.

Machinery Room

The machinery room would house the refrigeration equipment, hot water heater, air compressor, and other related equipment. It has a 5-foot doorway opening to the outside so that equipment can be repaired or replaced without having to be moved through the house. It is located adjacent to the freezer and meat aging and provision cooler and close to the meat cooler so that refrigeration lines will not have to be extended for unnecessarily long distances. The room is L-shaped and contains 624 square feet.

Inspector's Office

An office is set aside for the meat inspector, as required by most health and sanitation regulations. It is located on a hallway serving the offices and the workroom. The office is 7 by 9½ feet and also has a closet and a restroom with a toilet and lavatory.

Welfare Room

The welfare room is for the use of plant employees. Only one is provided since it is assumed that all plant workers would be male. It has a door opening into the hallway leading to the offices and to the workroom. The welfare room is divided into a locker room 10 by 12½ feet and a restroom 7 by 12½ feet. The welfare room has 12 lockers; space is allowed for 18.

General Offices

Four offices, three restrooms, and three closets are provided for management, sales, and clerical workers. The offices are 12½ by 19½ feet, 9½ by 16 feet, 17 by 9½ feet, and 12 by 12½ feet. All the offices have doorways into a hallway which leads to two outside doors and to the workroom.

Expansion of the House

The capacity of the custom service house can be expanded from 2,600,000 pounds to about 4,000,000 pounds annually based on the same product composition, if the outside wall common to the meat cooler and workroom is removed and rebuilt 12½ feet from its present location (fig. 10).

This expansion would shorten the length of storage of products in some areas and would require the purchase of some additional equipment; however, the flow, the efficiency, and the arrangement of areas would not be adversely affected.

The areas to be enlarged by moving the outside wall would be the meat cooler, the workroom, and the loading dock. The size of the remaining rooms would not be changed. The meat cooler expansion would allow for four more storage rails and one work rail and would increase its holding capacity on the rail to about 43,300 pounds. The workroom expansion would provide a storage rail for meats to be fabricated, three fabrication tables, work space, a service aisle, and a bandsaw in the fabrication area; a dial scale, packaging table, order desk, a 4-wheel cart, work space, and service aisles in the weighing and packaging area; and three skids for holding assembled orders for out-of-town shipments, and a platform scale in the order assembly area. Usually, an expansion of this magnitude means that out-of-town shipments are being made. Semilive skids (without racks) are used to assemble out-of-town orders which are packed in 50- to 60-pound boxes. The platform scale is used to weigh these boxes. The other operations performed in the workroom and the equipment involved should be adequate to handle the increase in volume of the expanded house. The loading dock expansion would permit another truck space at the dock, which should be more than adequate for the larger volume.

The meat aging and provision cooler would not be enlarged; however, some changes in the shelf space would be required. It is suggested that 28 feet of the floor space used for shelves for provisions be used for aging meats. Six shelves would be installed, giving a total of 168 linear feet of shelf space. This additional space would give the equivalent of almost 2 weeks' aging, based on the calculations used to figure the original shelf requirements.

The provision shelves remaining, 38 linear feet and 3 high, should be changed to 4 high to provide more selection, and provisions would have to be ordered more often since only about 1½ weeks' supply could be stored.

The freezer storage space would not be changed when the house is enlarged to handle 4,000,000 pounds annually. As a result, the

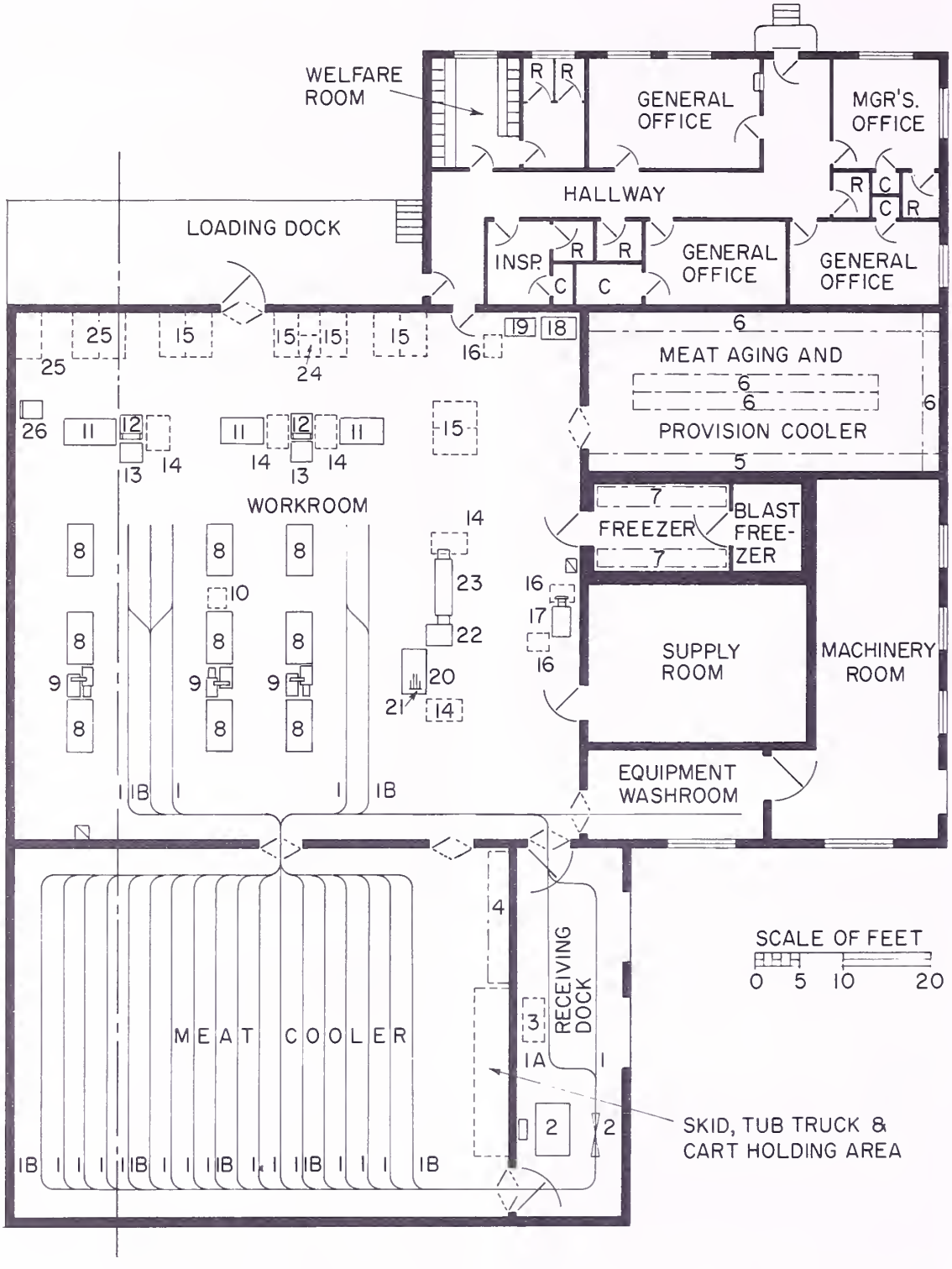

FIGURE 10.—Layout for a custom service hotel supply house enlarged from a capacity of 2,600,000 to about 4,000,000 pounds of meat and meat products annually.

Legend
1. Overhead transport & storage rail
1A. Overhead trolley storage rail
1B. Overhead work rail
2. Track & platform dial scale
3. Semilive skid storage
4. Pork storage shelves
5. Provisions storage shelves
6. Beef aging storage shelves
7. Frozen products storage shelves
8. Fabrication table
9. Bandsaw
10. Meat tying machine
11. Meat packaging table
12. Dial bench scale
13. Order desk
14. Four-wheel cart
15. Semilive skids with racks
16. Four-wheel tub truck
17. Meat grinder
18. Patty packing table
19. Patty former
20. Meat bagging table
21. Meat cut holder
22. Vacuum and clip machine
23. Hot water conveyor tunnel
24. Package tying machine
25. Semilive skid
26. Platform scale
R. Restroom
C. Closet
▨ Lavatory
— Walls removed for expansion

FIGURE 10.—Continued.

shelves for storing frozen packaged meats would hold about 1½ weeks' supply, so these items would have to be purchased more often.

The remainder of the house would not be changed, as it should be able to handle the volume increase without an undue loss in efficiency even though some areas would be used for longer periods each day.

The increase in volume of the house would require the gross square footage to increase from 10,587 to 12,050. This change of only 14 percent in area would achieve an increase in volume of about 54 percent.

APPENDIX

Miscellaneous Supporting Operations

Breaking Beef Quarters into Primal Cuts

The breaking of beef quarters into primal cuts could be considered part of the routine of service to customers in the few houses that purchased some beef as quarters; the first step in the preparation of some customer cuts was the breaking of the quarters. Most houses, however, purchased quarters only occasionally.

In the few houses visited that regularly purchased forequarters, the separating was usually done on the rail in the cooler by a meat cutter. A forequarter is normally separated into a rib, brisket, plate, and armbone chuck; however, on occasion variations in separating are made depending upon the needs of the house. The meat cutter used a knife, handsaw, and meat rule for measuring rib lengths, and a second long trolley hook to suspend part of the quarter during separation. Usually he had trolley trees on the work rail nearby for hanging ribs, briskets, and plates after they were separated. The armbone chuck was often left on the long trolley hook on the work rail until needed.

A hindquarter was usually separated into a flank, loin (kidney knob and hanging tenderloin not removed), and round. In the houses visited, the separating was done on the rail in the cooler by two workers. A meat cutter did all the cutting and sawing and a meat handler caught the flank and loin as they were separated and hung them on trolley trees. Table 15 shows the elapsed time, the labor requirements, and costs per 1,000 pounds for breaking forequarters and hindquarters.

Preparing Fabricated Meat Cuts for Aging

Meat cuts were aged in all the houses visited. The method used in most houses was to place the fabricated cuts in special plastic bags that practically eliminated shrinkage and surface deterioration during aging. When these bags were used, additional fabrication work on meat, after it was aged, was unnecessary for many types of cuts. This method of aging has been accepted by most customers and as a result many custom service houses no longer dry-age meat cuts on cooler shelves. Aging is usually limited to selected prime and choice beef cuts. Houses usually fabricate most of the pieces for aging from primal cuts; however, they often require more of one part of a primal cut than other parts, so they usually purchase these extra fabricated cuts trimmed to specifications and ready for preparing for aging. All houses try to schedule the fabrication and preparation of cuts for aging as soon as possible after they are received to minimize shrinkage.

Meat cuts in plastic bags have a shelf life in the cooler of about 14 to 21 days. This long shelf life permits a more balanced work load for the workers who prepare the daily customer orders for fresh meat cuts and also fabricate

TABLE 15.—*Breaking 1,000 pounds each of beef forequarters and hindquarters into primal cuts, on the rail*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Product and worker	Elapsed time	Labor required			Costs
		Productive	Unproductive	Total	
	Hours	*Man-hours*	*Man-hours*	*Man-hours*	*Dollars*
Forequarters (av. wt., 185 lb.): Meat cutter	0.26	0.26	0	0.26	0.91
Hindquarters (av. wt., 170 lb.):					
Meat cutter	.10	.10	0	.10	.35
Meat handler	.10	.06	.04	.10	.28
Total	.10	.16	.04	.20	.63

and prepare the cuts for aging, as they can do the latter work during low-volume periods either each day or on several days during the week. A few larger custom service houses, that sell a significant portion of their volume as aged meats, have a number of meat cutters and meat handlers regularly assigned to this job. These workers prepare cuts for inventory, based on anticipated sales, and place the cuts in plastic bags.

Two methods of transporting meat cuts from the fabrication area to the preparation for aging area were: (1) The meat cutter who fabricated cuts hand-carried about two cuts at a time; and (2) a meat handler transported about 9 cuts at a time on a 4-wheel cart.

Table 16 shows the labor requirements and costs per 1,000 pounds for these two methods. The savings in labor for the 4-wheel-cart transport method is due primarily to the fewer trips required per 1,000 pounds, since the meat handler has a greater transport distance in picking up an average of nine cuts per trip. A few houses, that prepared a good portion of their volume as aged meats, used a conveyorized worktable to transport meat cuts from the point of fabrication to a powered lazy susan which held a supply of cuts at the bagging table. No labor was required for transporting when the conveyorized worktable and lazy susan were used.

The two methods used in preparing meat for aging produced the same final product; however, one was more mechanized than the other and as a result required less labor. The first one is called the manual method. A meat handler placed one or two meat cuts in a bag. He then placed the bagged cut on the vacuum and clip machine, which removed the air from the bag, clamped a clip on it, and cut off the excess bag end. The worker put two bags at a time into a basket and dipped the basket into the hot water dip tank to shrink the bags tightly against the meat cuts. He later dated each bagged cut and placed them on a semilive skid. The second method is called the conveyor method. This method differed from the first one in that the worker used a meat cut holder to reduce the time required to place meat cuts in plastic bags, and a hot water conveyor tunnel transported the bagged cuts through the water and deposited them on a cart at the end of the conveyor. Another item of equipment used with the conveyor method was a holder for the material used to cover bone edges on ribs or other bone-in cuts. Tearing material off the roll in the holder was faster and easier than cutting strips of material with a knife.

TABLE 16.—*Transporting fabricated beef cuts from fabrication area to area for preparing meats for aging, by method*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Method and worker	Average transport distance	Average weight transported per trip [1]	Per 1,000 pounds	
			Labor required	Costs
	Feet	*Pounds*	*Man-hours*	*Dollars*
Manual transport by meat cutters (oral work order)	35	30	0.31	1.09
4-wheel cart transport by meat handler (written work order)	45	135	.19	.52

[1] Average weight of cut is 15 pounds.

Table 17 shows the labor requirements and costs per 1,000 pounds for each method as well as the average weight of each cut and the weight of each bag. It is assumed that knuckles and bottom butts are placed two to each bag.

The transporting of beef cuts prepared for aging to the shelves in the aging cooler is the final step in this operation. It was assumed that after 20 bagged products (300 pounds) are placed on either a semilive skid or a 4-wheel cart, they are transported an average distance of 65 feet and placed on shelves in the aging cooler. The labor required per 1,000 pounds is the same for both methods—0.18 man-hour; the cost is $0.50.

Transporting Barrels of Bones and Fat

Transporting barrels filled with bones and fat from the fabricating area to the loading dock and replacing them with empty barrels usually occurred two or three times a day. In houses that used regular fabrication tables, there were barrels (one for fat and one for bones) for each worker or two or more workers shared barrels.

In some houses that used the conveyorized fabricating table there were barrels at each work space. In others, the meat cutters placed the bones and fat on the belt with the meat cuts and a worker at the discharge end of the conveyor removed the fat and bones and placed them in the proper barrels. In other houses there were separate conveyors for bones and fat; the bones and fat fell into barrels at the discharge end of the conveyors. The use of separate conveyors to transport and dump fat

TABLE 17.—*Bagging and dipping beef in hot water to prepare for aging, by cut and by method*

LABOR REQUIREMENTS AND COSTS, CUSTOM SERVICE HOUSES

Fabricated beef cut	Average weight per—		Per 1,000 pounds			
			Manual method		Conveyor method	
	Cut	Bag	Labor required	Costs	Labor required	Costs
	Pounds	*Pounds*	*Man-hours*	*Dollars*	*Man-hours*	*Dollars*
Knuckles	10	20	0.99	2.72	0.81	2.23
Top rounds	18	18	1.25	3.44	1.02	2.81
Boneless strips	15	15	1.36	3.74	1.07	2.94
Full tenderloins	7	7	2.92	8.03	2.29	6.30
Bottom butts	6	12	1.62	4.46	1.27	3.49
Top butts	12	12	1.64	4.51	1.27	3.49
Oven prepared ribs	24	24	1.56	4.29	1.32	3.63
Average, all cuts			1.62	4.46	1.29	3.56

and bones into barrels eliminated the space requirements for barrels at the fabrication work areas and the rehandling of bones and fat. This method was the most costly, however, since barrels still had to be switched as they were filled and transported between the filling area and the dock, and the two powered belt conveyors were costly both to own and operate.

In most houses, one worker transported empty and filled barrels with a 2-wheel barrel truck, and exchanged them usually during a break or the lunch period.

Receiving and Storing Packaging Supplies

The receiving and storing of packaging supplies occurred weekly or more frequently, or perhaps an average of once or twice a month. The frequency usually depended upon the amount of storage space available, the types of supplies used, and the location of the suppliers. In general, houses that received and stored supplies once, or more than once, a week either had inadequate storage space or used nearby suppliers, and there was no great advantage in purchasing in quantity. Houses that received and stored supplies on an average of once or twice a month had ample storage space. They purchased in quantity from distant suppliers to take advantage of lower per-unit costs on large orders of specially printed or constructed containers. The driver and possibly a helper on the truck unloaded the supplies onto wheeled equipment and one or more house workers transported them to storage.

Some houses could not schedule the delivery of supplies, and the supplies often arrived at a time when the house workers who handled them were busy on jobs related to filling customer orders. As a result, the supplies were unloaded as quickly as possible in the nearest or most convenient location in the storage room. This often resulted in either an additional handling to rearrange the supplies at a later date, or a jumbled, unorganized storeroom where similar packaging products were stored in several locations or several different types of supplies were stacked together.

Transporting Packaging Supplies to the Work Areas

In houses with ample holding shelves or floor space at the packaging areas, supplies generally were transported in large quantities on wheeled equipment once or twice a day. All steak, chop, and patty boxes usually were set up at the packaging areas.

In some houses the packaging areas were crowded, and small quantities of supplies were manually transported many times each day. Boxes generally were set up in the storage room, as the space at the packaging area was inadequate for a supply of box flats to be held in stock until needed.

Most houses had workers set up a supply of boxes either at the packaging areas or in the storeroom when they were not needed to help fill customer orders.

In general, transporting a quantity of packaging supplies on wheeled equipment is more efficient than manual transport, since it eliminates numerous trips between the packing and the storage areas.

Cleaning Equipment and Facilities

The walls and floors and most fabricating and transporting equipment were usually cleaned at the end of each day. Equipment such as meat grinders, tub trucks, containers, and patty machines had to be cleaned periodically during the day because of an accumulation of unusable product on the inside or outside or because of a change in kind of product. Cleaning at the end of the day was done by one or more workers regularly assigned to this work or by all plant workers when they completed their work on filling customer orders. Usually fewer man-hours and less cleaning equipment and hot water were required when a regular crew was assigned the job. Most regularly assigned cleaning crews had a standard procedure to follow, knew the inspection service requirements, and did not waste time doing unnecessary work.

Arranging Products in Storage Rooms

The arranging of products in storage areas was normally performed once a week or more frequently either by the workers in charge of the storage area or by plant workers assigned the job during periods when they were not engaged in filling customer orders.

The operation should involve the orderly grouping of similar items and the rotating of stock so that items can be easily found when needed and the oldest stock used first. Many houses grouped and rotated stock and also placed items according to a plan based on the volume used, with items in the most demand placed at a convenient location. A few houses placed items in storage without a plan and, as a result, similar items were located at several points within the area. The first method of grouping, rotating, and locating stock according to volume used required more time because of the additional handling; however, it reduced the time required for workers selecting items for orders and permitted a better inventory control.

Maintaining Facilities and Equipment

Maintenance of facilities and equipment by house workers was usually limited to minor repairs to doors, plumbing, and electrical fixtures in the facility, and to adjusting, lubricating, and replacing worn or broken equipment parts. Normally this maintenance was handled by the meat cutters or meat handlers assigned to jobs within the areas where the repairs were to be made, and, if possible, was done at periods when the worker or workers were not engaged in filling customer orders. Often equipment broke down during busy periods and workers had to leave productive work to repair equipment. Other workers were idle until the equipment was back in operation. A few houses had good preventive maintenance programs; the facility and all equipment were inspected according to a regular procedure during nonproduction periods, so that potential trouble was often found and corrected before breakdowns slowed or stopped production. However, some operators seemed to consider a machine was in good repair as long as it was operating.

Equipment Costs and Labor Requirement Data

Cost figures for each item of equipment considered for the house with an annual volume of 2,600,000 pounds of meat and meat products, for both the selected and alternate methods described in the text, are shown in table 18. The assumed composition of customer cuts fabricated in this house on the peak-volume day is shown in table 19. Tables 20-23 show average productive labor requirements for transporting meat using trolleys on an overhead rail, a semi-live skid or 4-wheel cart, and a 2-wheel barrel truck, and for walking specified distances.

TABLE 18.—*Equipment ownership and operation costs*
CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Equipment	Amount of equipment	Size or capacity	Initial cost (f.o.b. factory)	Expected life [2]	Ownership cost				Operating cost			Total annual cost	Total annual usage	Cost per hour of use
					Depreciation	Interest (6 percent of average investment)	Insurance and taxes (4 percent of initial investment)	Total	Water and electricity [3]	Maintenance [4]	Total			
			Dollars	*Years*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Hours*	*Dollars*
Overhead rail[5, 6]	328 ft.	3/8×2½ in.	410.00	12	34.17	12.30	16.40	62.87	-------	4	4.00	66.87	364	0.1837
Overhead rail switches[5, 6]	14	-------	218.40	12	18.20	6.55	8.74	33.49	-------	2	2.00	35.49	364	.0975
Trolleys[5, 6]	145	-------	1,037.50	12	86.46	31.13	41.50	159.09	-------	2	2.00	161.09	364	.4425
Overhead rail[5, 7]	328 ft.	3/8×2½ in.	410.00	12	34.17	12.30	16.40	62.87	-------	4	4.00	66.87	258	.2591
Overhead rail switches[5, 7]	14	-------	218.40	12	18.20	6.55	8.74	33.49	-------	2	2.00	35.49	258	.1375
Trolleys[5, 7]	145	-------	1,037.50	12	86.46	31.13	41.50	159.09	-------	2	2.00	161.09	258	.6243
Overhead rail[5, 8]	442 ft.	3/8×2½ in.	552.50	12	46.04	16.58	22.10	84.72	-------	5	5.00	89.72	1065	.0842
Overhead rail switches[5, 8]	19	-------	338.55	12	28.21	10.16	13.54	51.91	-------	3	3.00	54.91	1065	.0516
Trolleys[5, 8]	145	-------	1,037.50	12	86.46	31.13	41.50	159.09	-------	2	2.00	161.09	1065	.1513
Overhead rail[5, 9]	442 ft.	3/8×2½ in.	552.50	12	46.04	16.58	22.10	84.72	-------	5	5.00	89.72	793	.1131
Overhead rail switches[5, 9]	19	-------	338.55	12	28.21	10.16	13.54	51.91	-------	3	3.00	54.91	793	.0692
Trolleys[5, 9]	145	-------	1,037.50	12	86.46	31.13	41.50	159.09	-------	2	2.00	161.09	793	.2031
Combination rail and platform dial scale[10]	1	1,600 lb.	2,000.00	12	166.67	60.00	80.00	306.67	-------	25	25.00	331.67	31	10.6990
Semilive skid[11]	1	36×60 in.	88.00	12	7.33	2.64	3.52	13.49	-------	1	1.00	14.49	58	.2498
Jacklift for semilive skid[11]	1	-------	60.00	12	5.00	1.80	2.40	9.20	-------	1	1.00	10.20	58	.1758
Semilive skid[12]	2	36×60 in.	176.00	12	14.67	5.28	7.04	26.99	-------	2	2.00	28.99	30	.9663
Jacklift for semilive skid[12]	2	-------	120.00	12	10.00	3.60	4.80	18.40	-------	2	2.00	20.40	30	.6800
4-wheel cart[13]	1	30×48 in.	100.00	12	8.33	3.00	4.00	15.33	-------	1	1.00	16.33	33	.4948
Fabrication table[14]	3	36×144 in.	1,320.00	12	110.00	39.60	52.80	202.40	-------	15	15.00	217.40	9770	.0225
Fabrication table[15]	6	36×72 in.	1,122.00	12	93.50	33.66	44.88	172.04	-------	18	18.00	190.04	9175	.0207
Bandsaw[16]	2	1½ hp.	1,400.00	12	116.67	42.00	56.00	214.67	21.55	76	97.55	312.22	532	.5868
Steak machine[16]	1	⅓ hp.	345.00	12	28.75	10.35	13.80	52.90	8.90	20	28.90	81.80	737	.1110
Portion over-under scale[16]	4	5 lb.	800.00	12	66.67	24.00	32.00	122.67	-------	60	60.00	182.67	1670	.1094
Portion or package over-under scale[14]	1	20 lb.	250.00	12	20.83	7.50	10.00	38.33	-------	15	15.00	53.33	942	.0566
Portion or package over-under scale[15]	1	20 lb.	250.00	12	20.83	7.50	10.00	38.33	-------	15	15.00	53.33	897	.0595
Meat tying machine[15]	1	-------	990.00	12	82.50	29.70	39.60	151.80	.75	50	50.75	202.55	77	2.6305
4-wheel tub truck[17]	5	225 lb.	565.00	12	47.08	16.95	22.60	86.63	-------	5	5.00	91.63	2026	.0452
4-wheel tub truck[18]	5	225 lb.	565.00	12	47.08	16.95	22.60	86.63	-------	5	5.00	91.63	1955	.0469
4-wheel tub truck[19]	5	225 lb.	565.00	12	47.08	16.95	22.60	86.63	-------	5	5.00	91.63	1860	.0493
4-wheel tub truck[20]	5	225 lb.	565.00	12	47.08	16.95	22.60	86.63	-------	5	5.00	91.63	1456	.0629
Meat grinder	1	5 hp.	875.00	12	72.92	26.25	35.00	134.17	46.95	50	96.95	231.12	514	.4496
Meat grinder	1	7½ hp.	1,100.00	12	91.67	33.00	44.00	168.67	63.20	70	133.20	301.87	479	.6302
Meat grinder	1	15 hp.	2,500.00	12	208.33	75.00	100.00	383.33	80.10	100	180.10	563.43	363	1.5521
Meat grinder	2	5 hp.	1,750.00	12	145.83	52.50	70.00	268.33	46.95	75	121.95	390.28	459	.8503
Patty package table[21]	1	32×48 in.	200.00	12	16.67	6.00	8.00	30.67	-------	-------	-------	30.67	829	.0370
Patty package table[22]	1	32×48 in.	200.00	12	16.67	6.00	8.00	30.67	-------	-------	-------	30.67	685	.0448
Patty forming machine with extra plates and stand[21]	1	-------	1,550.00	12	129.17	46.50	62.00	237.67	13.05	90	103.05	340.72	829	.4110
Patty forming machine with extra plates and stand[22]	1	-------	1,550.00	12	129.17	46.50	62.00	237.67	13.05	90	103.05	340.72	685	.4974
4-wheel cart[23]	2	-------	200.00	12	16.67	6.00	8.00	30.67	-------	2	2.00	32.67	730	.0447
Dial bench scale on wheeled stand[24]	1	100 lb.	800.00	12	66.67	24.00	32.00	122.67	-------	15	15.00	137.67	291	.4731

Package table[25]	1	32×96 in.	250.00	12	20.83	7.50	10.00	38.33				38.33	2136	.0179
Package table[26]	2	32×60 in.	450.00	12	37.50	13.50	18.00	69.00				69.00	1223	.0564
Package tying machine[26]	1		700.00	12	58.33	21.00	28.00	107.33	3.40	125	128.40	235.73	456	.5169
Semilive skid[27]	4	36×60 in.	352.00	12	29.33	10.56	14.08	53.97		4	4.00	57.97	1150	.0504
Jacklift for semilive skid[27]	2		120.00	12	10.00	3.60	4.80	18.40		2	2.00	20.40	857	.0238
Order delivery baskets[27]	260		1,820.00	3	606.67	54.60	72.80	734.07		130	130.00	864.07	1150	.7514
Semilive skid with 4 racks[28]	8	36×60 in.	1,400.00	12	116.67	42.00	56.00	214.67		12	12.00	226.67	826	.2744
Jacklift for semilive skid with racks[28]	1		60.00	12	5.00	1.80	2.40	9.20		1	1.00	10.20	365	.0279
Order delivery baskets[28]	260		1,820.00	3	606.67	54.60	72.80	734.07		130	130.00	864.07	826	1.0461
Meat bagging table[29]	1	32×96 in.	235.00	12	19.58	7.05	9.40	36.03				36.03	551	.0654
Meat bagging table[30]	1	32×60 in.	215.00	12	17.92	6.45	8.60	32.97				32.97	439	.0751
Meat cut holder[30]	1		150.00	12	12.50	4.50	6.00	23.00				23.00	439	.0524
Bone cover material holder[30]	1		30.00	12	2.50	.90	1.20	4.60				4.60	82	.0561
Vacuum and clip machine[29]	1		1,600.00	12	133.33	48.00	64.00	245.33	8.60	25	33.60	278.93	551	.5062
Vacuum and clip machine[30]	1		1,600.00	12	133.33	48.00	64.00	245.33	8.60	25	33.60	278.93	439	.6354
Hot water dip tank and basket[29]	1		450.00	12	37.50	13.50	18.00	69.00	84.90	25	109.90	178.90	551	.3247
Hot water conveyor tunnel[30]	1		2,400.00	12	200.00	72.00	96.00	368.00	99.50	50	149.50	517.50	439	1.1788
Semilive skid[29]	1	36×60 in.	88.00	12	7.33	2.64	3.52	13.49		1	1.00	14.49	612	.0237
Jacklift for semilive skid[29]	1		60.00	12	5.00	1.80	2.40	9.20		1	1.00	10.20	61	.1672
4-wheel cart[30]	2	30×48 in.	200.00	12	16.67	6.00	8.00	30.67		2	2.00	32.67	1003	.0326
2-wheel barrel truck[31]	1		60.00	12	5.00	1.80	2.40	9.20		1	1.00	10.20	60	.1700

[1] Based on an annual volume of 2,340,000 pounds of beef, veal, lamb, and pork primal cuts fabricated; 156,000 pounds of provisions; and 104,000 pounds of frozen packaged meats.

[2] Basis for expected life is U.S. Treasury Department, Internal Revenue Service Publication No. 456 (9–62).

[3] Based on 2.7 cents per kw.-hr. for electricity, and 0.03 cent per gallon for water.

[4] Based on estimates (rounded off to nearest dollar) made by operators, equipment manufacturing representatives, and the author.

[5] Total rail system consists of 770 feet of overhead rail, 34 overhead rail switches, and 290 trolleys.

[6] Estimated portion of rail system used in receiving meat with 1 worker.

[7] Estimated portion of rail system used in receiving meat with 2 workers.

[8] Estimated portion of rail system used in selecting and transporting primal cuts with the oral work order method.

[9] Estimated portion of rail system used in selecting and transporting primal cuts with the written work order method.

[10] Used for receiving beef, veal, lamb, and pork primal cuts with both methods.

[11] Used for receiving pork primal cuts, provisions, and frozen packaged meats with 1 worker.

[12] Used for receiving pork primal cuts, provisions, and frozen packaged meats with 2 workers.

[13] Used for selecting and transporting pork primal cuts with the written work order method.

[14] Used for fabricating cuts with the multiple worktable method.

[15] Used for fabricating cuts with the single worktable method.

[16] Used for fabricating cuts with both methods.

[17] Used for fabricating cuts with the multiple worktable, preparing ground meat with a 5-hp. grinder, forming and packaging patties with 2 workers, transporting meat in tub trucks, and weighing, packaging, and manual tying of bulk ground meat.

[18] Used for fabricating cuts with the multiple worktable, preparing ground meat with a 7½-hp. grinder, forming and packaging patties with 2 workers, transporting meat in tub trucks, and weighing, packaging, and manual tying of bulk ground meat.

[19] Used for fabricating cuts with the single worktable, preparing ground meat with a 15-hp. grinder, forming and packaging patties with one worker, transporting meat in tub trucks, and weighing, packaging, and machine tying of bulk ground meat.

[20] Used for fabricating cuts with the multiple worktable, preparing ground meat with two 5-hp. grinders (piggyback), forming and packaging patties with two workers, transporting meat in tub trucks, and weighing, packaging, and manual tying of bulk ground meat.

[21] Used for forming and packaging patties with 1 worker.

[22] Used for forming and packaging patties with 2 workers.

[23] Used for transporting fabricated cuts to the weighing area, selecting and transporting provision items and aged meats to the weighing area, and selecting and transporting ground meat patties, provisions items, and frozen packaged meats to the customer order baskets when written work and pickup orders are used.

[24] Used for weighing, packaging, and tying with both methods.

[25] Used for weighing, packaging, and manual tying.

[26] Used for weighing, packaging, and machine tying.

[27] Used for assembling and placing packages in customer baskets, transporting and placing customer baskets in storage, and loading out customer baskets when the unassigned delivery route method is used.

[28] Used for assembling and placing packages in customer baskets, and loading out customer baskets when the assigned delivery route method is used.

[29] Used for preparing meat for aging with the manual hot water dip method.

[30] Used for preparing meat for aging with the conveyor hot water dip method.

[31] Used for transporting barrels of bones and fat.

TABLE 19.—*Assumed composition of meats fabricated on a peak-volume day*

CUSTOM SERVICE HOUSE—ANNUAL VOLUME 2,600,000 POUNDS

Primal cut and customer cuts	Weight of customer cuts prepared		
	Total	For immediate delivery	For aging
	Pounds	*Pounds*	*Pounds*
Beef rounds (1,594 pounds):			
Rump and shank-off rounds	187	187	-------
Boned and trimmed rounds	300	300	-------
Boned and trimmed knuckles	125	---------	125
Boned and trimmed top rounds	225	90	135
Boned and trimmed bottom rounds	275	275	-------
Beef chucks, square cut (1,688 pounds):			
Strips for grinding	[1] 844	---------	-------
Stew meat	113	113	-------
4-oz. cube steaks (from shoulder clods)	300	300	-------
Beef loins, full trimmed (5,700 pounds):			
14-oz. steaks (from bone-in strips)	367	367	-------
Trimmed, boneless strips	375	187	188
16-oz. steaks (from boneless strips)	600	600	-------
Trimmed tenderloins	314	157	157
12-oz. steaks (from tenderloins)	225	225	-------
Trimmed bottom butts	570	270	300
Trimmed top butts	540	120	420
8-oz. steaks (from top butts)	375	375	-------
Beef ribs (1,875 pounds):			
Boned and trimmed rib-eye rolls	100	100	-------
Regular oven-prepared ribs	300	---------	300
Roast-ready ribs	675	675	-------
Veal hindsaddles (69 pounds):			
6-oz. veal chops	8	8	-------
Oven-prepared legs	43	43	-------
Lamb hindsaddles (50 pounds):			
4-oz. chops	9	9	-------
Oven-prepared legs	25	25	-------
Lamb foresaddles (50 pounds):			
4-oz. chops	9	9	-------
Shoulders	20	20	-------
Pork loins, regular (150 pounds):			
4-oz. chops	138	138	-------
Pork hams, regular (75 pounds):			
Boned and rolled hams	50	50	-------
Totals	6,268	4,643	1,625

[1] This volume is not included in the totals of fabricated cuts.

TABLE 20.—*Average productive labor requirements for transporting specified weight ranges of meat cuts on trolleys on overhead rails, for various distances*

Distance transported (feet)	Transport up to 250 lb.			Transport 251 to 800 lb.		
	Base time	Fatigue and personal allowance	Productive time	Base time	Fatigue and personal allowance	Productive time
	Man-hours	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*
5	0.0016	0.0002	0.0018	0.0020	0.0003	0.0023
10	.0026	.0003	.0029	.0034	.0005	.0039
15	.0032	.0003	.0035	.0044	.0007	.0051
20	.0038	.0004	.0042	.0052	.0008	.0060
25	.0044	.0004	.0048	.0060	.0009	.0069
30	.0050	.0005	.0055	.0070	.0011	.0081
40	.0060	.0006	.0066	.0083	.0012	.0095
50	.0071	.0007	.0078	.0096	.0014	.0110
60	.0080	.0008	.0088	.0108	.0016	.0124
70	.0090	.0009	.0099	.0120	.0018	.0138
80	.0100	.0010	.0110	.0134	.0020	.0154
90	.0110	.0011	.0121	.0147	.0022	.0169
100	.0120	.0012	.0132	.0160	.0024	.0184

TABLE 21.—*Average productive labor requirements for transporting specified weight ranges of meat and meat products on semilive skids, semilive skids with racks, tub trucks, and 4-wheel carts for various distances*

Distance transported (feet)	Transport up to 100 lb.			Transport 101 to 800 lb.		
	Base time	Fatigue and personal allowance	Productive time	Base time	Fatigue and personal allowance	Productive time
	Man-hours	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*
5	0.0014	0.0001	0.0015	0.0016	0.0002	0.0018
10	.0020	.0002	.0022	.0023	.0003	.0026
15	.0024	.0002	.0026	.0027	.0004	.0031
20	.0027	.0003	.0030	.0033	.0005	.0038
25	.0030	.0003	.0033	.0035	.0005	.0040
30	.0033	.0003	.0036	.0039	.0006	.0045
40	.0039	.0004	.0043	.0046	.0007	.0053
50	.0045	.0005	.0050	.0054	.0008	.0062
60	.0051	.0005	.0056	.0061	.0009	.0070
70	.0057	.0006	.0063	.0068	.0010	.0078
80	.0064	.0006	.0070	.0076	.0011	.0087
90	.0070	.0007	.0077	.0084	.0013	.0097
100	.0076	.0008	.0084	.0091	.0014	.0105

TABLE 22.—*Average productive labor requirements for transporting empty and filled barrels of meat, bones, and fat on a 2-wheel barrel truck, for various distances*

Distance transported (feet)	Transport empty barrels			Transport up to 350 lb.		
	Base time	Fatigue and personal allowance	Productive time	Base time	Fatigue and personal allowance	Productive time
	Man-hours	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*	*Man-hours*
5	0.0010	0.0001	0.0011	0.0014	0.0002	0.0016
10	.0016	.0002	.0018	.0020	.0003	.0023
15	.0019	.0002	.0021	.0024	.0004	.0028
20	.0022	.0002	.0023	.0027	.0004	.0031
25	.0026	.0003	.0029	.0031	.0005	.0036
30	.0029	.0003	.0032	.0034	.0005	.0039
40	.0035	.0004	.0039	.0041	.0006	.0047
50	.0041	.0004	.0045	.0048	.0007	.0055
60	.0048	.0005	.0053	.0055	.0008	.0063
70	.0054	.0005	.0059	.0062	.0009	.0071
80	.0060	.0006	.0066	.0068	.0010	.0078
90	.0066	.0007	.0073	.0075	.0011	.0086
100	.0073	.0007	.0080	.0082	.0012	.0094

TABLE 23.—*Average productive labor requirements for walking specified distances*

Distance walked (feet)	Base time	Fatigue and personal allowance	Productive time
	Man-hours	*Man-hours*	*Man-hours*
5	0.0008	0.0001	0.0009
10	.0012	.0001	.0013
15	.0015	.0002	.0017
20	.0018	.0002	.0020
25	.0023	.0002	.0025
30	.0026	.0003	.0029
40	.0033	.0003	.0036
50	.0040	.0004	.0044
60	.0046	.0005	.0051
70	.0053	.0005	.0058
80	.0059	.0006	.0065
90	.0064	.0006	.0070
100	.0070	.0007	.0077

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